POLARAD

HANDBOOK OF OPERATING AND MAINTENANCE INSTRUCTIONS

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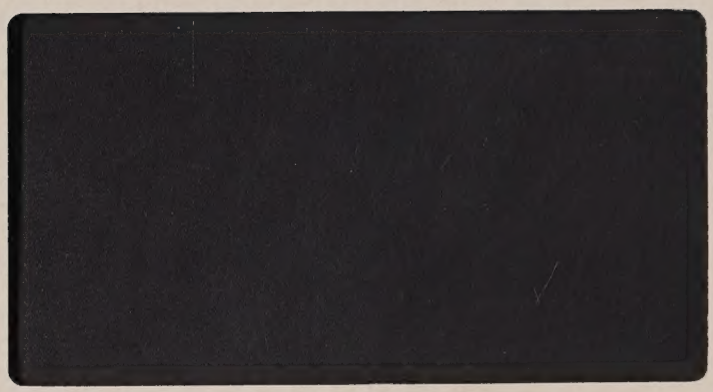

POLARAD

INSTRUCTION MANUAL

ANTENNA PATTERN
RECEIVER
MODEL RW-T
(2.0 TO 75 GC)

POLARAD ELECTRONIC INSTRUMENTS

A DIVISION OF POLARAD ELECTRONICS CORPORATION

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ADDENDA
MODEL RW-T

The equipment changes listed below apply to serial numbers 5-1 and up only.

In figure 5-1:

a. Change R1403 from "47K, 2W" to "33K, 2W".

b. Change R1404 from "47K, 2W" to "33K, 2W".

c. Change R1422 from "680K" to "560K".

In Table 6-2, incorporate the changes listed below.

REF SYMBOL	DESCRIPTION	MFR'S PART NO.	MFR'S CODE	MAINT QTY
R1403 AND R1404	RESISTOR, COMPOSITION, 33K, 10 PCT, 2W/MIL STD PART NO. MS35045-22	RC42GF333K	AU	1
R1409	RESISTOR, COMPOSITION, 47K, 10 PCT, 2W/MIL STD PART NO. MS35045-23	RC42GF473K	AU	1
R1422	RESISTOR, COMPOSITION, 560K, 10 PCT, 1/2W/MIL STD PART NO. MS35043-220	RC20GF564K	AU	1

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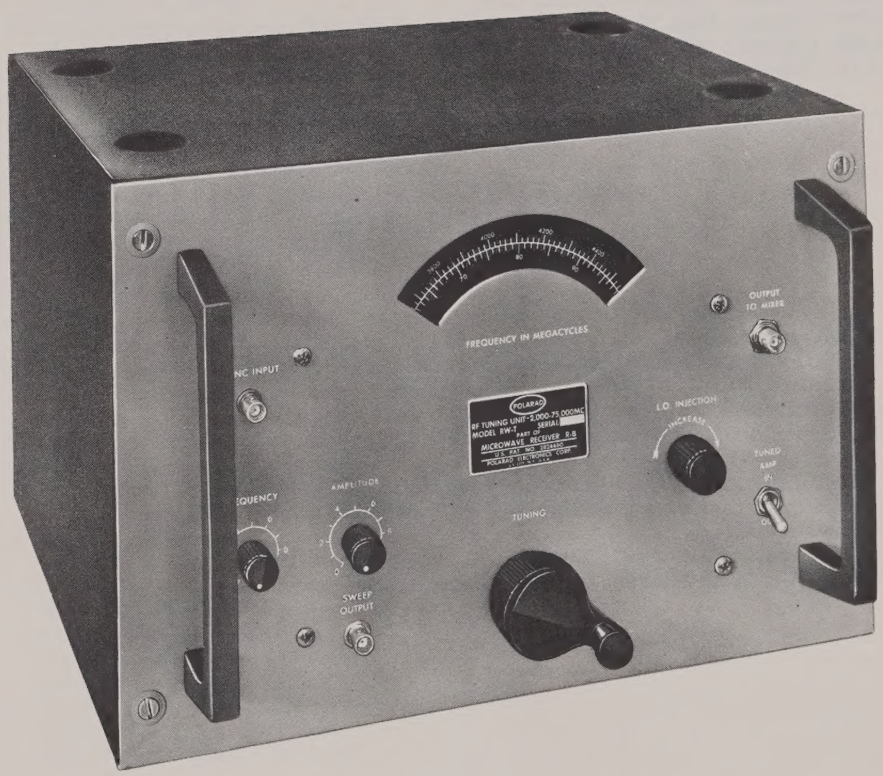

Figure 1-1. Model RW-T Tuning Unit

SECTION I
GENERAL DESCRIPTION

Note

Refer to the handbook for the Model R Microwave Receiver which covers the Model R-B1 Basic Unit of the receiver. This handbook supplements the Model R handbook and provides coverage for the Model RW-T Tuning Unit.

1-1. INTRODUCTION.

1-2. TUNING UNIT. The Model RW-T Tuning Unit is available as a part of the Model R Microwave Receiver (figure 1-1) and provides broad frequency coverage from 2 to 75 gc. The tuning unit is primarily used for antenna measurements in its frequency range, but it is also capable of some of the other applications listed in Section I of the Model R handbook.

1-3. GENERAL CONSTRUCTION. The Model RW-T Tuning Unit contains an external cavity klystron local oscillator, a protective diode, a frequency-selective tee, a tracking potentiometer, a mechanical system to drive these components, a preamplifier, a tuned amplifier, and a phantastron sweep generator.

1-4. TUNING CONTROLS. The Model RW-T is tuned to the desired frequency by rotating the TUNING knob, located at the bottom center of the front panel. Rotation of the knob drives a calibrated dial, a cam that actuates a plunger in the oscillator cavity and the tracking potentiometer. The L.O. INJECTION control changes the position of the attenuator probe in the oscillator cavity, which permits the control of the power available at the OUTPUT TO MIXER connector. The FREQUENCY control varies the frequency of the sweep generator from 900 to 1100 cps, and the AMPLITUDE control varies the output of the sweep generator from zero to 30 volts.

1-5. ACCESSORY EQUIPMENT.

1-6. ACCESSORIES SUPPLIED. An externally mounted first mixer, Model XM-2 (2 to 10 gc) is provided with the Model RW-T. The necessary accessory cables are provided with the Model R Microwave Receiver. The tuning unit is shipped with tubes, semiconductors, and indicator lamps installed.

1-7. ACCESSORIES AVAILABLE AS OPTIONAL EXTRA ITEMS. Table 1-1 lists the accessories available as optional extra items.

1-8. ELECTRICAL CHARACTERISTICS.

1-9. The Model R Microwave Receiver, which utilizes the Model RW-T Tuning Unit to cover the frequency range from 2 to 75 gc, is a precision measuring device. The electrical characteristics peculiar to the Model RW-T Tuning Unit and those of the Model R Microwave Receiver that are affected by the Model RW-T Tuning Unit are listed below:

Frequency Range	2 to 75 gc
Local Oscillator Injection	Adjustable
Sensitivity:	
2 to 10 gc	-85 dbm
10 to 35 gc	-80 dbm
35 to 75 gc	-70 dbm
Range of Linearity:	
With AGC	60 db
40 mc Output	40 db
Electron Sweep:	
Sweep Rate	900 - 1100 cps
Maximum Sawtooth Amplitude	30 volts
Sync Input	15 volts, minimum
Sync Rate	1000 cps

1-10. ELECTRON TUBE AND SEMICONDUCTOR COMPLEMENT.

1-11. Table 1-2 lists the electron tubes and semiconductors used in the RW-T Tuning Unit.

TABLE 1-1. OPTIONAL ACCESSORIES

Item	Function	Part or Model No.
X-Band Waveguide Mixer	Externally-mounted first mixer for range from 8.2 to 12.4 gc	XM-8
Ku-Band Waveguide Mixer	Externally-mounted first mixer for range from 12.4 to 18 gc	XM-12
K-Band Waveguide Mixer	Externally-mounted first mixer for range from 18 to 26.5 gc	XM-18
Ka-Band Waveguide Mixer	Externally-mounted first mixer for range from 26.5 to 40 gc	XM-26
Q-Band Waveguide Mixer	Externally-mounted first mixer for range from 33 to 50 gc	XM-33
V-Band Waveguide Mixer	Externally-mounted first mixer for range from 50 to 75 gc	XM-50

TABLE 1-2. ELECTRON TUBE AND SEMICONDUCTOR COMPLEMENT

Reference Symbol	Tube Type	Function
	TUNING UNIT	
V1401	6X4	Protective diode
V1402	6AS6	Phantastron generator
V1403	12AX7	Phantastron generator
V1404	5836	Reflex klystron
V1405	12AX7	Tuned Amplifier
	PREAMPLIFIER	
V1451	5876	I-f amplifier
V1452	5876	I-f amplifier
CR1451	1N82A	Second mixer

SECTION II
INSTALLATION AND OPERATION

2-1. GENERAL.

2-2. The RW-T Tuning Unit is shipped either installed in a Model R Receiver, or packed in a separate shipping case. In either case, the tuning unit is ready for use. Observe the usual precautions for unpacking a delicate instrument.

2-3. Inspect the interior of the equipment. Check to make sure that all tubes are firmly seated in their sockets, that all tube shields are properly in place, and that all inter-unit cabling connections are firm and secure.

CAUTION

DO NOT TAMPER WITH THE KLYSTRON OSCILLATOR CAVITY OR ANY OF THE ASSOCIATED TRACKING MECHANISM AS THIS HAS BEEN CAREFULLY ADJUSTED AT THE FACTORY.

2-4. INSTALLATION.

2-5. To install the tuning unit into the basic instrument, perform the following steps:

CAUTION

BEFORE ATTEMPTING TO INSTALL THE MODEL RW-T TUNING UNIT INTO THE BASIC INSTRUMENTS, BE SURE TO ROTATE THE TUNING DIAL TO 2400 OR ABOVE.

a. Pull out the extension slides, located in the front panel opening of the basic unit, to their maximum extension.

b. Place the tuning unit on the slides, making sure that the two slide locating screws are properly seated in their slots.

c. Connect all interconnecting cables in accordance with Table 2-1.

d. Slide the tuning unit into the space provided at the front of the basic instrument.

e. Secure the tuning unit to the basic instrument by means of the four captive fasteners, located at the corners of the tuning unit front panel.

TABLE 2-1. INTERCONNECTING CABLES

Cable	Plug	Connect to Jack	Located On
W116	P119	J1401	Tuning Unit
W101	P101	J1453	Preamplifier
W102	P103	J1452	Preamplifier
W122	P116	J205	Preamplifier
W102	P1411	J406	IF amplifier
W107	P112	J1412	Main chassis

2-6. OPERATING CONTROLS AND CONNECTORS.

2-7. The operating controls and connectors for the RW-T Tuning Unit are listed in Table 2-2 and shown in Figure 2-1.

2-8. PRELIMINARY OPERATING PROCEDURE.

2-9. Before attempting to operate the receiver, check that the line input voltage switch is set to the proper line voltage. The receivers normally are factory set for 115 volt operation. If 230 volt operation is desired the line input switch must be set to the 230V position. To do this, proceed as follows:

a. Loosen camlocks in back of unit with screwdriver and remove dust cover.

b. Place the line input switch located on the basic's left rear side to the desired position and replace the dust cover.

2-10. When it has been determined that the line input switch is properly set for the line voltage being used, proceed as follows:

a. Place the POWER ON and AFC switches in the off position.

b. Connect P124, at one end of the power cord, to the power input receptacle on the rear of the receiver. Connect the other end of the power cord to the ac power source.

c. Turn the POWER ON switch to the ON position. Check that the POWER lamp lights and that, after a 60 second delay, the KLYSTRON lamp lights.

d. Allow the receiver to warm up for at least 20

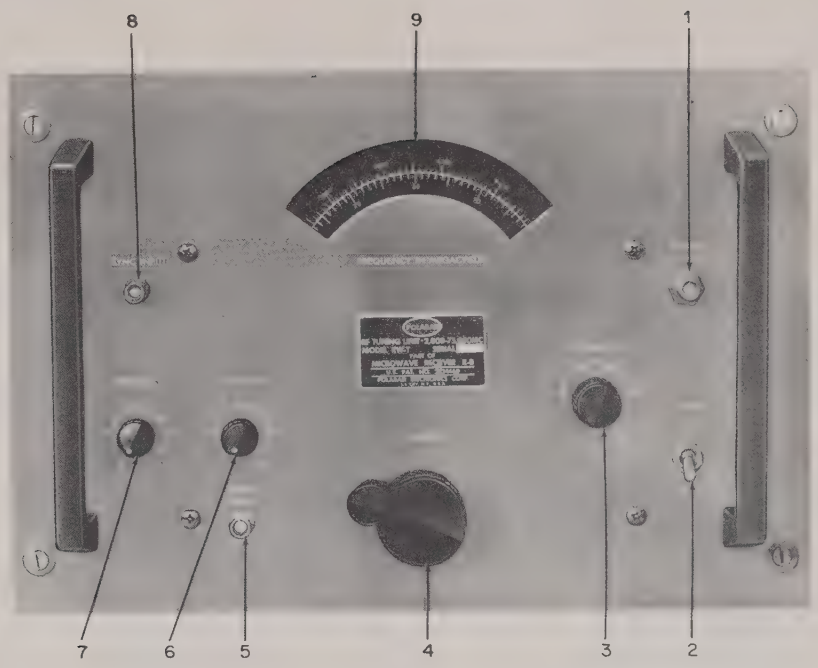

Figure 2-1. Operating Controls and Connectors

TABLE 2-2. OPERATING CONTROLS AND CONNECTORS

Figure 2-1 Index No.	Control or Connector	Function
1	OUTPUT TO MIXER jack	Supplies signals to and receives signals from the externally mounted first mixer.
2	TUNED AMP IN OUT switch.	Connects a narrow-band 1 kc tuned amplifier stage to the detector output to provide increased sensitivity through reduced bandwidth. Removes amplifier from circuit when in the OUT position.
3	L.O. INJECTION control.	Controls the penetration of the attenuator probe into the klystron cavity. Permits an adjustment for optimum power transfer from the oscillator to the OUTPUT TO MIXER jack.
4	TUNING control.	Determines the frequency of the klystron oscillator and positions the FREQUENCY IN MEGACYCLES dial to that frequency.
5	SWEEP OUTPUT connector.	Provides an output of the internal 1 kc sweep generator for external use.
6	AMPLITUDE control.	Determines the amplitude of the signal developed by the internal 1 kc sweep generator. This amplitude may be varied from 0 to 30 volts.
7	FREQUENCY control.	Determines the frequency of the internal 1 kc sweep generator. The range of this control is from 900 to 1100 cps.
8	SYNC INPUT connector.	Permits an external 1 kc signal source to be used to trigger the internal 1 kc sweep generator.
9	FREQUENCY IN MEGACYCLES dial.	Indicates the frequency of the klystron oscillator to within ±1%.

minutes.

WARNING

DANGEROUS HIGH VOLTAGES ARE PRESENT IN THE MAIN CHASSIS AND THE TUNING HEAD. DO NOT ATTEMPT TO OPERATE THE RECEIVER WITH THE DUST COVER REMOVED OR TO PERFORM ADJUSTMENTS WITHIN THE MAIN CHASSIS OR TUNING HEAD WHEN THE POWER IS ON.

2-11. OPERATING PROCEDURE.

2-12. RECEIVER GAIN CALIBRATION. Before performing measurements which utilize the RW-T Tuning Head, the meter should be calibrated by using the inherent receiver noise as a reference. To do this, proceed as follows:

a. Place the MANUAL-CALIBRATE switch to the CALIBRATE position.

b. Set the METER SELECTOR switch to the USE position.

c. Set the AVERAGE PEAK switch to the AVERAGE position.

d. Set the METER SCALE switch to the LIN position.

e. Set the TUNED AMP IN OUT switch to the OUT position.

f. The AFC ON switch should be in the OFF position.

g. Set the AM-FM switch to the AM position.

h. Adjust CALIBRATE GAIN until meter reads CAL on LIN scale.

i. Set METER SCALE switch to 30 DB or 70 DB.

j. Adjust the ZERO SET control until the meter reads 0 on the LIN scale.

k. The meter has now been compensated for inherent instrument noise. The CALIBRATE GAIN control should now be left undisturbed. When making measurements requiring a calibrated meter, place the MANUAL CALIBRATE switch in the CALIBRATE position and use the CALIBRATE GAIN control to rezero the meter.

2-13. CHECKING RECEIVER SENSITIVITY. The receiver sensitivity can be checked with a microwave signal generator having a variable output attenuator accurately calibrated in dbm (Polarad Model MSG, PMX, or EHF) and a standing wave amplifier having a scale calibrated in db (PRD 277B or equivalent). If desired, the receiver output may be measured at the 40 MC OUTPUT connector using a suitable mount (such as PRD Model 613 with Type 610-A bolometer). Measure the receiver sensitivity by performing the following procedure:

a. Set the front panel controls as follows:

(1) Set the MANUAL-CALIBRATE switch to the MANUAL position.

(2) Set the METER SELECTOR switch to the USE position.

(3) Set the AFC ON switch to the off position.

(4) Set the AVERAGE-PEAK switch to the AVERAGE position.

(5) Set the METER SCALE selector switch to the LIN position.

(6) Set the TUNED AMP switch to the OUT position.

b. Connect the standing wave amplifier to the VIDEO OUTPUT jack.

c. Connect the Coaxial Mixer XM-2 to the OUTPUT TO MIXER connector.

d. Apply a 3000 mc signal from the signal generator to the external mixer.

e. Set the signal generator for zero or minimum output.

f. With the METER SCALE switch in the LIN position and no output from the signal generator, adjust the MANUAL GAIN control to obtain a meter reading of 0.5 on the LIN scale.

g. Adjust the signal generator output attenuator to provide a signal at the -50 dbm level.

h. Set the FREQUENCY IN MEGACYCLES dial of the Model RW-T to approximately 3260. (If the 3000 mc input frequency is not being used, tune the RW-T to approximately 260 mc above the signal frequency.)

i. Tune in the signal to be measured as follows:

(1) Set the METER SELECTOR switch to the XTAL MA position and adjust the L.O. INJECTION control for a cyrstal current of 0.5 to 0.75 ma as indicated on the LIN scale of the meter.

(2) Return the METER SELECTOR switch to the USE position and adjust the TUNING knob for a maximum deflection of the panel-mounted meter.

(3) Adjust the FREQUENCY control until a maximum reading is obtained on the standing wave amplifier.

(4) Alternately adjust the L.O. INJECTION and

TUNING controls for a maximum reading on the standing wave amplifier.

(5) Alternately adjust the AMPLITUDE and TUNING controls for a maximum reading on the standing wave amplifier.

Note

Several repetitions of steps (4) and (5) may be required for the highest possible meter reading. Such repetitions will be reduced as the operator obtains experience in performing the adjustments.

j. Turn the signal generator attenuator to obtain minimum or no output. Note the reading of the noise level on the standing wave amplifier.

Note

Make certain that the signal being received is the desired fundamental of the signal generator and not a harmonic. Detailed instructions for setting the RW-T tuning dial are given in paragraph 2-25.

k. Adjust the signal generator attenuator until the standing wave amplifier reading increases by 3 db. The receiver sensitivity may then be read off the signal generator attenuator dial.

l. If a bolometer is to be used, connect the bolometer mount to the 40 MC OUTPUT connector and perform the same procedure outlined in steps a through k.

2-14. MEASUREMENT OF ANTENNA PATTERN. When the calibration gain and receiver sensitivity checks of paragraphs 2-12 and 2-13 have been performed, the instrument is ready to perform antenna pattern measurements. Practically any standard make ac antenna pattern recorder may be used in conjunction with this receiver. To perform the antenna pattern measurements, connect the antenna pattern recorder and bolometer to the 40 MC OUTPUT jack and proceed as follows:

a. Set the MANUAL-CALIBRATE switch to the MANUAL position.

b. Set the AFC ON switch to the OFF position.

c. Set the METER SELECTOR switch to the USE position.

d. Set the AVERAGE-PEAK switch to the AVERAGE position.

e. Set the METER SCALE selector switch to the LIN position.

f. Set the TUNED AMP switch to the OUT position.

g. With no signal present, adjust the MANUAL GAIN control to obtain a meter reading of 0.5 on the LIN scale.

h. Apply a 3000 mc signal at the -50 dbm level from a signal generator (Polarad MSG series or equivalent) and set the FREQUENCY IN MEGACYCLES dial to approximately 3260. Other signal frequencies may be used by referring to paragraph 2-25 for tuning instructions.

i. Set the METER SELECTOR switch to the XTAL MA position and adjust the L.O. INJECTION control for a crystal current of 0.5 to 0.75 ma as indicated on the bottom scale of the meter.

j. Return the METER SELECTOR switch to the USE position and adjust the TUNING knob for a maximum deflection of the meter.

k. Adjust the FREQUENCY control until a maximum reading is obtained on the recorder.

l. Alternately adjust the L.O. INJECTION and TUNING controls for a maximum reading on the recorder.

m. Alternately adjust the AMPLITUDE and TUNING controls for a maximum reading on the recorder.

Note

Several repetitions of steps (1) and (m) may be required for the highest possible meter reading. Such repetitions will be reduced as the operator obtains experience in performing the adjustments.

n. Comparative measurements of signal strength may now be made with the receiver.

Note

External synchronization of the sweep oscillator should be used when the output is being registered on an extremely narrowband recorder. To do this, connect a stable 1 kc source, of at least 15 volts peak, to the SYNC INPUT jack.

2-15. OTHER SPECIFIC MEASUREMENTS.

2-16. The Polarad Model RW-T Tuning Unit may be used for other applications besides antenna pattern measurements. The measurements of cw, pulse-modulated, am and fm signals is explained in para-

graphs 2-17 through 2-22.

2-17. MEASURING CW SIGNALS. Field intensity, interference, and r-f leakage investigations usually involve continuous-wave signals. To measure such signals, proceed as follows:

a. If the frequency of the signal to be measured is known, set the FREQUENCY IN MEGACYCLES dial in accordance with the instructions given in paragraph 2-25. If the frequency of the received signal is to be determined by reading off the RW-T tuning dial, observe the precautions regarding harmonic and image frequencies.

b. Set the front panel control as follows:

(1) Place the MANUAL-CALIBRATE switch in the CALIBRATE position.

(2) Set the AFC ON switch to the off position.

(3) Set the METER SELECTOR switch to the USE position.

(4) Set the FUNCTION SELECTOR switch to the AVERAGE position.

(5) Set the METER SCALE switch to the LIN position.

(6) Set the TUNED AMP switch to the OUT position.

(7) With no input present, adjust the CALIBRATE GAIN control to obtain a reading of 1.5 (or CAL) on the linear scale.

(8) Set the AVERAGE-PEAK switch to the PEAK position.

(9) Set the METER SCALE selector switch to the 70 DB position.

(10) Set the TUNED AMP switch to the IN position.

(11) Adjust the ZERO SET control until the meter reads zero on the linear scale.

(12) Set the METER SELECTOR switch to the XTAL MA position and adjust the L.O. INJECTION control for a crystal current of 0.5 to 0.75 ma as indicated on the XTAL MA scale of the meter.

(13) Return the METER SELECTOR switch to the USE position and set the METER SCALE switch to the 30 DB or 70 DB position, depending upon the strength of the incoming signal.

(14) Adjust the FREQUENCY control for a maximum indication on the meter.

(15) Alternately adjust the L.O. INJECTION and TUNING controls for a maximum indication on the meter.

(16) Alternately adjust the AMPLITUDE and TUNING controls for a maximum indication on the meter.

Note

Steps (15) and (16) may require several repetitions for a true maximum reading. Such repetitions will be reduced as the operator obtains experience in performing the adjustments.

(17) Comparative measurements of signal strength, in db, may now be made with the meter.

Note

If the signal level is too low for usable readings on the 30 DB scale, place the METER SCALE switch in the LIN position and use the linear voltage scale of the meter. If accurate comparisons of very low-level signals are required, a calibrated external attenuator must be used. (See paragraph 2-23 for use of an external attenuator.)

2-18. MEASURING PULSE-MODULATED SIGNALS. The comparative power level of pulse-modulated signals may be measured by setting up the equipment as in paragraph 2-17 with the following exceptions:

a. Set the TUNED AMP switch to the OUT position.

b. Set the AM-FM switch to the AM position.

c. Turn the AMPLITUDE control fully counterclockwise.

Note

The FREQUENCY control will have no effect during these measurements.

2-19. Pulse envelopes may be compared by connecting an oscilloscope to the VIDEO OUTPUT jack. The pulses may be monitored aurally, if the duty cycle is sufficiently high and the pulse repetition rate falls within the auditory range, by monitoring at the AUDIO OUTPUT jack. The AUDIO GAIN control may be adjusted to control the audio signal level.

2-20. Pulsed signals, 10 db above the tangental signal sensitivity, provide triggering pulses of 10 volts across a 100 ohm load. To obtain these pulses, connect a cable and a 100 ohm shunt resistor to the TRIGGER OUTPUT jack.

2-21. MEASURING A-M SIGNALS. For power measurements of amplitude-modulated signals, follow the procedure given for the measurement of CW signals in paragraph 2-17, except that the repetition rate should not be close to 1 kc or errors may be introduced by a zero beat from the tuner phantastron. Modulation frequencies which fall within the audio range may be aurally monitored by placing the AM-FM switch in the AM position and taking the signal from the AUDIO OUTPUT jack. In addition, an oscilloscope may be connected to the VIDEO OUTPUT jack for observation of the modulation envelope.

Note

When monitoring modulation frequencies within the audio range, make certain that the AMPLITUDE control is maximum counterclockwise and the TUNED AMP switch is in the OUT position.

2-22. MEASURING F-M SIGNALS. For power measurements of frequency-modulated signals, follow the procedure given for the measurement of CW signals in paragraph 2-17, except that the repetition rate should not be close to 1 kc or errors may be introduced by a zero beat from the tuner phantastron. Modulation frequencies which fall within the audio range may be aurally monitored by placing the AM-FM switch in the FM position, and taking the signal from the AUDIO OUTPUT jack. In addition, an oscilloscope may be connected to the VIDEO OUTPUT jack for observation of the modulation envelope.

Note

When monitoring modulation frequencies within the audio range, make certain that the AMPLITUDE control is maximum counterclockwise and the TUNED AMP switch is in the OUT position.

2-23. USING AN EXTERNAL ATTENUATOR. For accurate comparisons of the power level of r-f signals, a calibrated external attenuator (Daven Attenuator, Type 651-R or equivalent) may be used. Set up the equipment as follows:

a. Remove the coaxial cable strap jumping the PREAMP OUTPUT and IF INPUT jacks. Connect the calibrated attenuator between these jacks.

b. Set up the instrument for the type of signal to be measured according to paragraphs 2-17 through 2-22.

Note

For very low-magnitude signals, place the METER SCALE selector in the LIN position and take readings on the lower linear voltage scale.

c. Connect the first r-f signal to be measured to the input of the externally mounted first mixer or, if an antenna pattern measurement is being made, point the antenna in the desired direction.

d. Adjust the external attenuator until a convenient meter deflection is obtained. For maximum accuracy the weakest signal level should be at least 10 db above the no-signal or noise level. Note the db setting of the external calibrator.

e. Apply the second r-f signal to be measured to the input of the externally mounted first mixer, or turn the antenna to the second position.

f. Adjust the external attenuator until the meter reading is the same as that obtained in step (4). Note the db setting of the external attenuator.

g. Take the difference between the two db settings of step d and step f. This is the difference, in db, between the average power of the two signals. Any number of signals may be compared in this way.

2-24. USING EXTERNAL SYNCHRONIZATION. The FREQUENCY control is normally used in tuning to adjust the phantastron sweep generator over the range of 900 to 1100 cps. This generator must be synchronized from a stable source when using an extremely narrow band antenna pattern recorder. To synchronize the sweep generator, apply a stable 1 kc signal, of at least 15 volts peak, to the SYNC INPUT jack and turn the FREQUENCY control to 4 (below 1 kc). The sawtooth output of the sweep generator is also available for external use. It is obtained by connecting a cable to the SWEEP OUTPUT jack.

2-25. SETTING THE TUNING DIAL. The FREQUENCY IN MEGACYCLES dial has two scales. The upper scale indicates the frequency and the lower scale is a linear reference scale to aid in tuning. The linear reference scale may be used together with Table 2-3 to determine the klystron oscillator harmonic to which the RW-T receiver is being tuned and to set the dial at that harmonic. If the desired frequency does not fall exactly on an oscillator harmonic, the dial may be tuned to the nearest harmonic and the TUNING knob adjusted until the desired frequency is obtained. Two examples are given below. The procedure is the same for all frequencies within the tuning range.

a. To tune the RW-T receiver to 3500 megacycles, proceed as follows:

(1) Add or subtract 260 megacylces from the frequency to be received. If the oscillator is tuned above the incoming signal, add 260 megacycles to obtain an oscillator frequency of 3760 mc.

(2) Refer to Table 2-3. Note that 3760 does not appear under the LINEAR SCALE SETTING table, but 3600 appears under number 59 and 3800 appears under number 67. The desired frequency of 3760 megacycles lies between 59 and 67 on the linear scale.

TABLE 2-3. KLYSTRON LOCAL OSCILLATOR FREQUENCIES

LINEAR SCALE SETTING														
H	0	2	10	18	26	35	43	51	59	67	76	84	92	100
1	2150	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600
2	4300	4400	4800	5200	5600	6000	6400	6800	7200	7600	8000	8400	8800	9200
3	6450	6600	7200	7800	8400	9000	9600	10200	10800	11400	12000	12600	13200	13800
4	8600	8800	9600	10400	11200	12000	12800	13600	14400	15200	16000	16800	17600	18400
5	10750	11000	12000	13000	14000	15000	16000	17000	18000	19000	20000	21000	22000	23000
6	12900	13200	14400	15600	16800	18000	19200	20400	21600	22800	24000	25200	26400	27600
7	15050	15400	16800	18200	19600	21000	22400	23800	25200	26600	28000	29400	30800	32200
8	17200	17600	19200	20800	22400	24000	25600	27200	28800	30400	32000	33600	35200	36800
9	19350	19800	21600	23400	25200	27000	28800	30600	32400	34200	36000	37800	39600	41400
10	21500	22000	24000	26000	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000
11	23650	24200	26400	28600	30800	33000	35200	37400	39600	41800	44000	46200	48400	50600
12	25800	26400	28800	31200	33600	36000	38400	40800	43200	45600	48000	50400	52800	55200
13	27950	28600	31200	33800	36400	39000	41600	44200	46800	49400	52000	54600	57200	59800
14	30100	30800	33600	36400	39200	42000	44800	47600	50400	53200	56000	58800	61600	64400
15	32250	33000	36000	39000	42000	45000	48000	51000	54000	57000	60000	63000	66000	69000
16	34400	35200	38400	41600	44800	48000	51200	54400	57600	60800	64000	67200	70400	73600
17	36550	37400	40800	44200	47600	51000	54400	57800	61200	64600	68000	71400	74800	78200

(3) Slowly move the TUNING knob between 59 and 67 until a maximum indication is obtained on the panel meter, standing wave amplifier, or whatever output device is being used. Note that the exact spot on the linear dial may be found by interpolation. The frequency difference between 3600 and 3800 is 200 megacycles and the numerical difference on the linear scale is the difference between 59 and 67, or 8. Thus, each division on the linear scale represents 200 divided by 8, or 25 megacycles. If the FREQUENCY IN MEGACYCLES dial is set to exactly 59 on the linear scale, the local oscillator will be at 3600 megacycles and every division to the right will add 25 megacycles. Three divisions, or 62, will represent 3600 +75 or 3675 megacycles. Number 63 will be 3700 megacycles and 65 will be 3750 megacycles. This is very close to the desired oscillator frequency of 3760 megacycles and the exact frequency may be tuned-in now with ease.

(4) Alternately adjust the TUNING and L.O. INJECTION controls until a maximum output is obtained.

(5) Referring again to Table 2-3, note that the left hand column appears under the letter H. This represents the oscillator harmonic to which the receiver is being tuned. Since the number one corresponds to the column used for 3662 megacycles, the receiver is being tuned to a fundamental frequency.

b. To tune the RW-T receiver to 35, 000 megacycles, proceed as follows:

(1) Add or subtract 260 megacycles from the desired frequency. Suppose that it is desired to have the oscillator below the frequency or at 34, 738 megacycles (35, 000 minus 260).

(2) Refer to Table 2-3. Note that 34, 738 megacycles does not appear under the LINEAR SCALE SETTING, but 34, 000 appears under number 51 and 36, 000 appears under number 59. The desired frequency of 34, 738 megacycles lies between 51 and 59 on the linear dial.

(3) The frequency difference between 34, 000 and 36, 000 is 2, 000 megacycles. The numerical difference between 51 and 59 is 8. Thus, each division represents 2, 000 divided by 8 or 250 megacycles.

(4) Set the FREQUENCY IN MEGACYCLES dial to number 51 on the linear scale. The number 51 corresponds to an oscillator frequency of 34, 000 megacycles and the corresponding number under the H column indicates that this is the tenth harmonic. Moving the dial three divisions to the right will add 3 times 250 or 750 megacycles, producing an oscillator frequency of 34, 000 + 750 or 34, 750 megacycles. This is close to the desired oscillator frequency of 34, 738 megacycles and the exact frequency now is easily obtained.

(5) Alternately adjust the TUNING and L.O. INJECTION controls for maximum output.

SECTION III
THEORY OF OPERATION

3-1. GENERAL.

3-2. PURPOSE AND USE OF EQUIPMENT. The Model R Microwave Receiver with the Model RW-T Tuning Unit is a versatile laboratory and field instrument, providing broad frequency coverage over the range of 2 to 75 gc by means of a single precision plug-in tuning head. It permits comparative power and frequency measurements, by means of its panel-mounted meter, of virtually every type of signal found in microwave work. In addition, it provides audio, video, recorder, bolometer, trigger, and sweep outputs for monitoring of these signals.

3-3. A specific application of the equipment is use as a broadband receiver providing signal strength information directly into any standard antenna pattern recorder. The receiver may also be used for field intensity, interference and r-f leakage measurements of cw, fm, am, and pulse-modulated signals.

3-4. BLOCK DIAGRAM ANALYSIS (Figure 3-1). The Polarad Model R Microwave Receiver with the Model RW-T Tuning Unit basically is a triple-conversion superheterodyne receiver having a final i.f. output frequency of 40 mc. The first two frequency conversions are done within the RW-T tuning unit to provide a 140 mc signal to the first i-f amplifier of the receiver.

3-5. The RW-T Tuning Unit contains a reflex klystron first oscillator V1404 (see figure 3-1) which provides the local oscillator signal via a frequency selective tee to an external crystal mixer. The external mixer may be mounted directly at the antenna and is coupled to the OUTPUT TO MIXER jack of the tuning unit via coaxial cable. The klystron oscillator is tuned by means of the TUNING control on the front panel to a frequency either 260 mc above or below the incoming signal. The external crystal mixer then produces a 260 mc first i.f. signal which is coupled back through the frequency selective tee to the preamplifier. The preamplifier provides two stages of amplification and a second crystal conversion from a 120 mc oscillator located within the basic unit of the receiver. The result is a 140 mc output signal from the tuning unit at the PREAMP OUTPUT jack.

3-6. The RW-T Tuning Unit contains a phantastron sweep generator to generate and apply a 1 kc sawtooth voltage to the repeller of the klystron oscillator tube. This repeller signal will shift the oscillator frequency by an amount proportional to the amplitude of the sawtooth and produce frequency modulation of the oscillator. The deviation will be at a 1 kc rate and is effectively converted to amplitude modulation within the i-f strip of the receiver. A narrow-band tuned amplifier (V1405) may be used in conjunction with this sweep generator circuit to provide increased sensitivity of the meter circuits for CW antenna pattern measurements. The sawtooth output of the sweep generator is available at SWEEP OUTPUT jack J1408. In addition, the sweep generator frequency may be controlled by an accurately calibrated sync signal applied to SYNC INPUT jack J1402.

3-7. DETAILED CIRCUIT ANALYSIS.

3-8. FIRST LOCAL OSCILLATOR. The first local oscillator circuit uses a reflex klystron tube which can be continuously tuned over the range of 2150 to 4600 mc. The klystron tube contains two resonator grids which are separated from the cathode by a control grid which controls the rate of flow of electrons from the cathode. The repeller electrode, located at the opposite end of the tube from the cathode, operates at a negative potential with respect to the cathode. The reflex klystron develops a velocity modulation of the electron stream with a resulting induced r-f field produced at the resonator grids.

3-9. TUNING FIRST LOCAL OSCILLATOR. The operating frequency of the klystron first oscillator is primarily determined by an external coaxial-type cavity resonator. The cavity employed is in the form of a coaxial transmission line, and consists of two cylinders, one inside the other. The klystron tube is inserted at one end of this line, so that the outer cylinder makes contact with the first interaction grid (so termed because it is closer to the cathode), while the inner cylinder makes contact with the second interaction grid. At the other end, the circuit is completed by a movable non-contacting shorting plunger of special construction. The position of this movable short determines the resonant frequency of the cavity. The shorting plunger is operated by a mechanical drive system that is coupled to the TUNING control and the FREQUENCY IN MEGACYCLES dial.

3-10. FIRST LOCAL OSCILLATOR REPELLER TRACKING. The klystron repeller voltage is made variable from -325 volts to approximately -925 volts because, for any given setting of the resonant cavity, there is an optimum value of repeller voltage for maximum r-f power. A tracking arrangement is used to maintain the repeller voltage at the optimum value as the oscillator is tuned over its range of 2150 to 4600 mc. This tracking is controlled by potentiometer

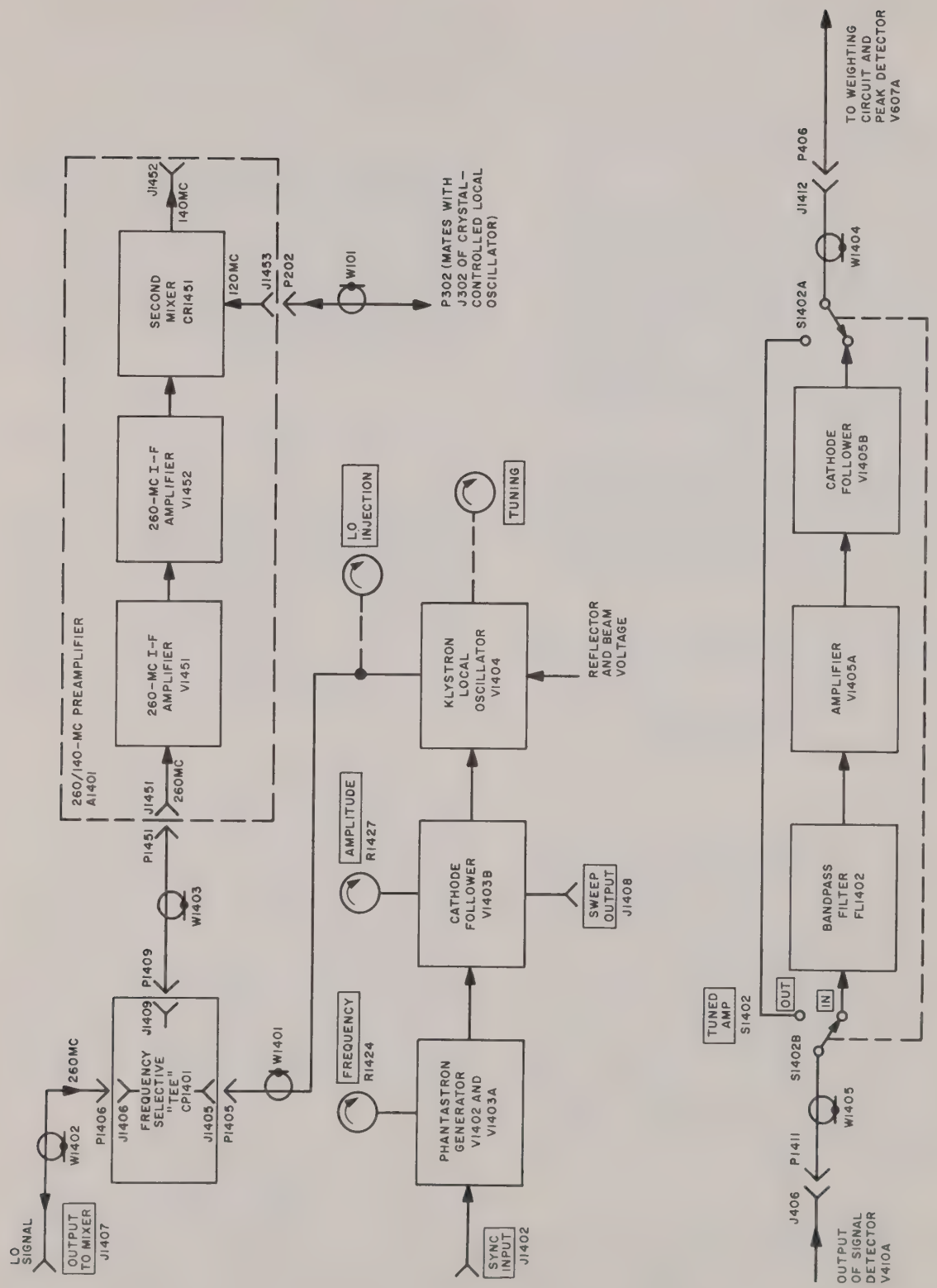

Figure 3-1. Model RW-T Tuning Unit, Block Diagram

R1406 which has the center arm mechanically ganged to the oscillator cavity choke. Values of resistors in the tracking circuit are selected to insure that the proper frequency-versus-voltage characteristic is obtained for the repeller electrode. LOW ADJ., TRACK I ADJ., TRACK 2 ADJ, HIGH ADJ controls are provided on the potentiometer control panel to set the voltage applied to the wirewound potentiometer, R1406. The rotation of the TUNING dial actuates the automatic mode selector switch S1401, which changes the repeller voltage modes at a predetermined point in the frequency range. (The klystron oscillator operates in two modes, the 1-3/4 and the 2-3/4 mode.) Limited changes of the operating frequency are possible by variations in the repeller voltage and this fact is utilized by the sweep generator circuit described in paragraph 3-14.

3-11. FIRST LOCAL OSCILLATOR OUTPUT. R-f energy is coupled from the klystron cavity resonator by a variable loop coupling at a point within the cavity. The movement of the loop, or attenuator probe, is controlled by the L.O. INJECTION knob on the front panel. The attenuator probe is adjusted, together with the cavity plunger and repeller tracking potentiometers, during tuning to provide optimum power at the desired frequency. The power available from the attenuator probe is delivered to one arm of a frequency selective tee which couples it via the OUTPUT TO MIXER jack to the external first mixer. The frequency selective tee presents the proper match to transmit the oscillator energy via the RG-71/U cable to the external mixer. The resultant frequencies developed by the cyrstal mixer are also present in the same cable, including the 260 mc i-f signal. The frequency selective tee presents the proper impedance terminations to direct the 260 mc signal into the preamplifier jack J1451 while preventing 260 mc signal absorption at oscillator output jack, J1405.

3-12. PROTECTIVE DIODE. The repeller voltage of the klystron tube must not become positive with respect to the cathode or damage to the tube may result. The protective diode V1401 is connected between the cathode and repeller electrodes to prevent such tube damage. The cathode, pin 7, of the diode is connected directly to the cathode of the klystron, to which the -325 volt potential is applied. Since the plates, pins 1 and 6, of the diode are directly connected to the repeller electrode of the klystron, any circuit disturbance causing the diode plates (or the repeller electrode) to become more positive than -325 volts will drive tube V1401 into conduction. When V1401 is in a conducting state, the maximum positive repeller voltage is the small drop across the diode. In this manner, the repeller electrode of tube V1404 is maintained at a minimum absolute potential of -325 volts.

3-13. PREAMPLIFIER. The preamplifier receives signals from the external crystal mixer, through the frequency-selective tee, at a frequency of 260 mc. The preamplifier amplifies the 260 mc signal and then converts it to a lower i-f of 140 mc. This 140 mc signal is applied to the input of the i-f amplifier circuit within the basic instrument. The first two stages, V1451 and V1452, function as a cascade tuned amplifier, to increase the magnitude of the 260 mc input signal from the mixer via the frequency-selective tee. The crystal (CR1451) functions as a second mixer, receiving two signals. One signal of 120 mc is derived from a crystal controlled oscillator. By heterodyning the 260 mc second stage output with the 120 mc crystal-controlled oscillator output in the second mixer, a difference frequency of 140 mc is coupled via r-f choke L1458 and capacitor C1467 to coaxial connector J1452. Coaxial cable W102 applies the 140 mc signal to the PREAMP OUTPUT jack J101, mounted on the front panel of basic unit. Coaxial cable W103 functions as a jumper between the front panel PREAMP OUTPUT jack and the IF INPUT jack J104. For accurate comparisons of signals, an external calibrated attenuator can be used as a substitute for coaxial cable W103. The 140 mc signal is applied to the i-f amplifier where further amplification and frequency conversion take place.

3-14. PHANTASTRON SWEEP GENERATOR. The purpose of the phantastron generator is to develop and apply a 1 kc sawtooth voltage to the repeller of the klystron oscillator tube. This sawtooth voltage causes the oscillator frequency to deviate in proportion to the change in repeller voltage, thus frequency modulating the oscillator at a 1 kc rate. The frequency of oscillation may be varied over the range of 900 to 1100 cps by the FREQUENCY control R1480, located on the front panel of the tuning unit. Also, the frequency may be controlled by positive trigger pulses applied to the suppressor grid of V1402 via SYNC INPUT jack J1402.

3-15. The phantastron circuit contains two cathode followers in the twin-triode circuits of V1403. V1403A is part of the phantastron circuit and steepens the trailing edge of the sawtooth by providing a charging path for C1404 when the plate current of V1402 cuts off. Cathode follower V1403B provides the output voltage to the repeller circuit and to the SWEEP OUTPUT jack. The amplitude of the sawtooth voltages may be varied from zero to 30 volts by AMPLITUDE control R1427, located on the front panel of the tuning unit. The maximum sawtooth voltage will vary the oscillator frequency over a range of approximately 5 to 10 megacycles.

3-16. TUNED AMPLIFIER. The f-m modulation produced by the phantastron sweep generator is utilized for increased sensitivity by use of the narrow-band tuned amplifier V1405. Normally, the output of the AGC detector in the basic unit is applied to the meter circuits. If TUNED AMP switch S1402 is placed in the IN position, the tuned amplifier V1405 is placed between the AGC output and the meter circuits.

3-17. When the sweep generator frequency modulates the klystron oscillator at a 1 kc rate, the i-f signal within the receiver is deviated about the center frequency. The AMPLITUDE control of the tuning unit may be adjusted to apply enough sawtooth voltage to

cause the i-f signal to deviate more than 3 mc, which is the bandpass of the i-f. When this happens, the AGC detector will operate as a slope detector to demodulate the 1 kc signal. The output of the AGC detector is applied, via S1402, to the input of the tuned amplifier, which contains a highly selective 1 kc filter, amplifies it and operates the meter or narrow-band recorder. This effective sharpening of the bandpass effectively increases the sensitivity of the receiver and is particularly useful during antenna pattern measurements. Because of the sharp selectivity of the tuned amplifier and recorder circuits, it is advisable to sync the sweep generator from a stable 1 kc source when using extremely narrow band recorders for antenna pattern measurements.

SECTION IV
MAINTENANCE

4-1. GENERAL.

4-2. This section covers corrective maintenance procedures for the Model RW-T Tuning Unit used in the Model R Microwave Receiver. Included are the alignment procedures which may be required to restore the tuning unit to peak operating efficiency, following maintenance and repair.

4-3. TROUBLESHOOTING.

4-4. MECHANICAL TROUBLES. The mechanical drive system employed in the Model RW-T Tuning Unit should not be tampered with unless a mechanical breakdown occurs. Mechanical re-adjustment should be made only as a last resort and only by thoroughly competent personnel. When re-adjustment in the mechanical drive system is required for electrical reasons, proceed as directed in paragraph 4-17.

CAUTION

DO NOT TAMPER WITH THE KLYSTRON TUBE OR ANY OF ITS ASSOCIATED MECHANISM UNLESS THE TROUBLE HAS BEEN DEFINITELY ISOLATED TO THAT CIRCUIT. REPLACEMENT OF THE KLYSTRON TUBE MAY INVOLVE RE-ADJUSTMENT OF THE TRACKING AND CALIBRATION CIRCUITS.

4-5. ELECTRICAL TROUBLES. The panel-mounted meter on the basic unit can be used as the indicating device in trouble shooting. With the METER SELECTOR switch rotated to the USE position, the meter and its associated circuitry are essentially a vacuum-tube voltmeter. In the other positions of the METER SELECTOR switch, the meter serves as a test voltmeter or ammeter, and is connected to various points in the power supply or tuning unit circuits. Some methods of performing electrical trouble shooting are as follows:

a. Any subassembly may be isolated from the rest of the circuitry by removing the signal cables connected to it. Signal substitution may then be used to sectionalize the source of trouble.

b. Functional analysis of the operation of the instrument may give an indication as to the defective assembly. Checking the various modes of operation and the various outputs from these modes will aid in isolating the trouble. Refer to the schematic diagrams in Section V of the basic receiver manual for output locations of the designated stages.

c. The alignment procedures described in this section may be used to isolate trouble. Failure to obtain the specified signal levels may indicate improper functioning of that subassembly which is being aligned.

d. Table 4-1 lists performance standards for the basic unit. These may be used to determine if a particular section is functioning normally.

e. Table 4-2 provides a basic trouble shooting procedure for the Model RW-T Tuning Unit. Reference should be made to the tuning unit block diagram, Figure 3-1, as an aid in understanding the signal flow between the various assemblies.

4-6. KLYSTRON LOCAL OSCILLATOR, TUBE REPLACEMENT. (Figure 4-1)

4-7. Replacement of the Type 5836 klystron first oscillator tube usually requires adjustment of the bias and repeller tracking controls. Do not remove the klystron tube before eliminating other possible faults. If a microwave tube tester (Polarad Model K-200 or equivalent) is available, check out the suspected klystron without disturbing the tracking adjustments. If tube substitution is used, do not expect a new klystron to operate properly without re-adjustment of bias and tracking potentiometers.

4-8. REMOVAL OF KLYSTRON. When it has been reasonably determined that the klystron tube is defective, it may be removed from the RW-T Tuning Unit by performing the following procedure:

WARNING

DANGEROUS HIGH VOLTAGES EXIST WITHIN THE TUNING UNIT. DO NOT ATTEMPT TO REMOVE THE KLYSTRON TUBE UNLESS THE LINE POWER CORD IS DISCONNECTED FROM THE RECEIVER.

CAUTION

BE SURE TO ROTATE THE TUNING DIAL TO 2400 MC OR HIGHER BEFORE PULLING OUT THE TUNING UNIT.

TABLE 4-1. BASIC UNIT TROUBLESHOOTING CHART

Step	Preliminary Action	Normal Indication	If Indication is Abnormal - Probable Cause
1	Determine proper setting of 115-230 volt switch for available input voltage		
2	Place POWER ON switch to ON position	POWER indicator on	Basic unit is not functioning properly. See Table 4-1 in Model R manual.
3	Time delay of 60 seconds after step 2	KLYSTRON indicator on	Same as step 2
4	Place METER SELECTOR switch S104 in ANODE V position	The pointer of METER M101 will deflect to a reading within the area marked VOLT	Same as step 2
5	Place METER SELECTOR in REFL V position	Same as step 4	Same as step 2
6	Place METER SELECTOR in ANODE MA position	The pointer of METER M101 will deflect to a reading between 5 and 8 on the LIN scale	Same as step 2
7	Place METER SELECTOR in +120 position	Same as step 4	Same as step 2
8	Place METER SELECTOR in -108 position	Same as step 4	Same as step 2
9	Remove the front panel jumper W103. Set the MANUAL GAIN control for maximum, and AVERAGE-PEAK switch in the AVERAGE position	Meter M101 should read about 1.5 on LIN scale	Same as step 2

TABLE 4-2. MODEL RW-T TUNING UNIT TROUBLESHOOTING CHART

Symptom	Test Point	Normal Indication	If Indication is Abnormal - Probable Cause and Remedy
Low sensitivity	Front panel meter M101	Check the sensitivity as directed in paragraph 2-11 of this manual. The sensitivity should be -85 dbm between 2 and 10 kmc, -80 dbm between 10 and 35 kmc, and -70 dbm between 35 and 75 kmc	Check klystron anode current, by placing the METER SELECTOR in ANODE MA position, for a reading of 5 to 8 on red linear scale. Check klystron tube, tubes V1401, V1402 and CR1451. Check sweep output voltage at the SWEEP OUTPUT jack. Also check the tuned amplifier V1405 and its associated circuitry. Check the sweep output voltage of the sweep generator at the SWEEP OUTPUT jack. Check preamplifier circuitry.
Low noise level	Front panel meter M101	Set MANUAL GAIN control to maximum, TUNED AMP switch to OUT, and AVERAGE-PEAK switch to the AVERAGE position. Meter M101 should read 3 to 5 on the red linear scale due to the noise voltages generated in the preamplifier.	Check V1401, V1402 and the associated circuitry of the preamplifier chassis.
Low or no sensitivity with the TUNED AMP switch on the IN position	Front panel meter M101	When the TUNED AMP switch is placed on the IN position the meter M101 sensitivity should increase.	Check the 1000 cps tuned amplifier V1405 and associated circuitry within the RW-T Tuning Unit. If the tuned amplifier is not defective, check the 1000 cps sweep voltage output of the Phantastron Sweep Generator at the SWEEP OUTPUT jack.
Sweep voltage output at the SWEEP OUTPUT jack is not within specifications	SWEEP OUTPUT jack, J1408	The frequency sawtooth can be varied from 900 to 1100 cps and the maximum amplitude should be 30 volts	Check the phantastron sweep generator tubes V1402, V1403 and the associated circuitry.

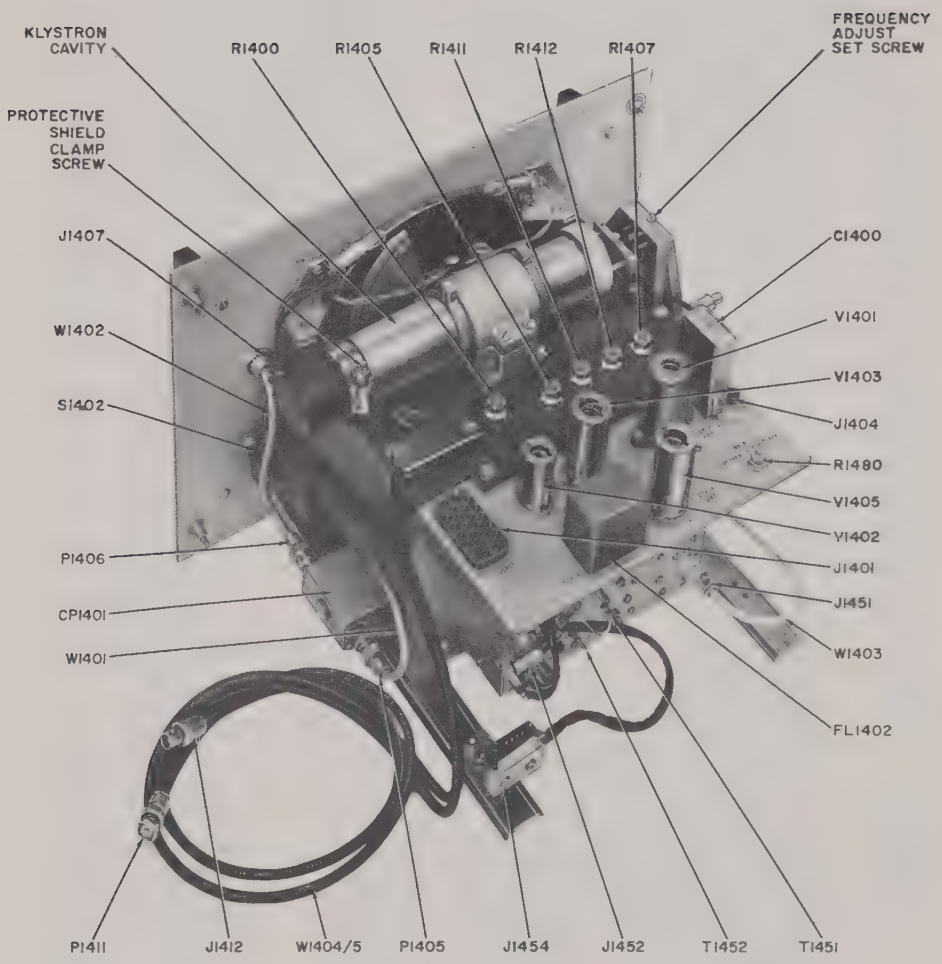

Figure 4-1. Model RW-T Tuning Unit, Left Rear View

a. Loosen the four captive fasteners located at the corners of the tuning unit front panel. Withdraw the tuning unit from the front of the receiver cabinet until the oscillator cavity is exposed. The klystron tube is partially seated within the right end of the oscillator cavity with the tube base covered by a protective shield.

b. Loosen the single screw which clamps the protective shield to the right end of the oscillator cavity. Remove the shield so that the tube socket and cavity are accessible.

c. Gently pull the tube socket assembly away from the base of the klystron tube.

d. Use a spanner wrench to loosen the knurled collar at the end of the cavity.

Note

Do not remove the knurled collar completely from the cavity.

e. Grasp the projecting end of the klystron tube, gently rotating it in a clockwise direction, while simultaneously withdrawing the tube from the spring holders within the cavity. If the projecting end of the tube cannot be grasped securely, it may then be necessary to remove the large knurled collar at the end of the cavity. The collar is removed with one spring and one retaining ring. After extracting the tube, replace the knurled collar as follows:

(1) Insert one spring back into the cavity.

(2) Insert the retaining ring back into the cavity.

(3) Replace the knurled collar by threading it approximately one-half turn onto the cavity.

4-9. REPLACEMENT OF KLYSTRON. If a different 5836 klystron tube is installed, the alignment procedures of paragraph 4-12 must be done following the installation. To insert a klystron into the cavity, proceed as follows:

a. Gently push the klystron tube into the center of the cavity, and press it all the way in, against a noticeable resistance. (This resistance is an indication that the inner conductors of the cavity are sliding over the collar at the end of the tube.) Continue pushing the tube into the cavity, giving the tube a clockwise twist, until it meets a positive stop, in the forward direction.

b. Retighten the knurled collar at the left end of the cavity.

c. Attach the socket assembly to the base of the replacement klystron tube.

Note

Carefully observe the arrangement of the four pins at the base of the tube and the mating connectors on the tube socket. Do not use excessive force in replacing the socket assembly on the tube base as it is possible to insert the socket in a misaligned position, causing damage to the klystron.

d. Replace the protective shield over the protruding socket of the tube, using the screw loosened in step 4-8b to secure the shield to the cavity.

4-10. BIAS ADJUSTMENT.

WARNING

IN PERFORMING THE FOLLOWING STEPS, CONSTANTLY BE AWARE OF THE HIGH VOLTAGES EXISTING AT VARIOUS POINTS IN THE TUNING UNIT. REMOVE OPERATING POWER WHENEVER MAKING METER CONNECTIONS. USE INSULATED TOOLS AND EXERCISE CAUTION AT ALL TIMES.

4-11. When klystron replacement makes a bias adjustment necessary, proceed as follows:

a. Remove the a-c line cord from the power source and partially withdraw the tuning unit from the main assembly. The Bias Adj potentiometer is located near the center of the chassis, just behind the klystron tube (see figure 4-1).

b. Loosen the locknut on the potentiometer shaft and rotate the shaft fully counterclockwise.

c. Place the METER SELECTOR switch in the ANODE MA position to check klystron anode current.

d. Connect the power cable to the receptacle at the rear of the receiver and turn the POWER ON switch to its ON position. Allow a ten-minute warm-up period.

e. Set the Bias Adj potentiometer for a reading of 7 on the red linear scale of the panel meter. After the bias adjustment has been made, tighten the locknut on the Bias Adj potentiometer.

4-12. REPELLER VOLTAGE TRACKING AND OSCILLATOR CALIBRATION.

4-13. Variations in tube characteristics will usually require re-adjustment of repeller tracking and oscillator calibration whenever a klystron is replaced.

The procedures for these tests are given in paragraphs 4-15 and 4-17 respectively. Both these tests require the same test setup which is given in paragraph 4-14.

4-14. TEST SETUP REQUIRED. The test set required for the tracking and calibration tests is shown in figure 4-2. The items required for these tests are as follows:

a. Wavemeters, such as FXR types N410A and N4114A, or equivalent.

b. A high gain oscilloscope, such as a Tektronix 532, or equivalent.

c. An external first mixer, such as Polarad Model XM-2.

d. A Simpson Model 260 multimeter, or equivalent.

e. A Polarad Model MK-1 alignment generator, or equivalent.

f. A 6 to 8 inch length of RG-9/U cable.

4-15. REPELLER VOLTAGE TRACKING ADJUSTMENT. To perform the repeller voltage tracking adjustments, proceed as follows:

a. Remove tuning unit tube V1403 from its socket and turn the AMPLITUDE control fully clockwise.

b. Set up the multimeter to monitor the repeller supply voltage, as follows:

(1) Connect the negative test prod of the voltmeter to terminal N-1850(-925) on TB103 (main chassis of the basic unit).

(2) Connect the positive test prod of the voltmeter to terminal F-1250 on TB103.

(3) With AFC ON switch in the off position, adjust REFL. V ADJ. control R125 on the power supply for a reading of 600 volts on the meter.

c. Re-adjust the REFL. V ADJ. control R125 to maintain a meter pointer deflection of 600 volts during the remaining steps of the adjustment procedure.

d. Use equipment shown in figure 4-2 for the test setup which is described in steps e through g.

e. Connect a video cable from the vertical input of the oscilloscope to the input connector of the external first mixer.

f. Connect the first mixer to the OUTPUT TO MIXER jack on the front panel of the Model RW-T.

g. Connect the Polarad Model MK-1 alignment generator as follows:

(1) Connect REFLECTOR output leads to jacks J1403 and J1404 on the RW-T Tuning Unit.

(2) Connect H SCOPE leads to the horizontal input of the oscilloscope.

(3) Set the AMP control fully counterclockwise.

h. Place the POWER ON switch in the ON position and allow a ten minute warm-up period.

i. Adjust the modulation AMP control of the Model MK-1 until the sides of the klystron mode trace are visible on the oscilloscope.

j. Adjust the PHASE control of the Model MK-1 until the two traces are superimposed as shown in figure 4-3.

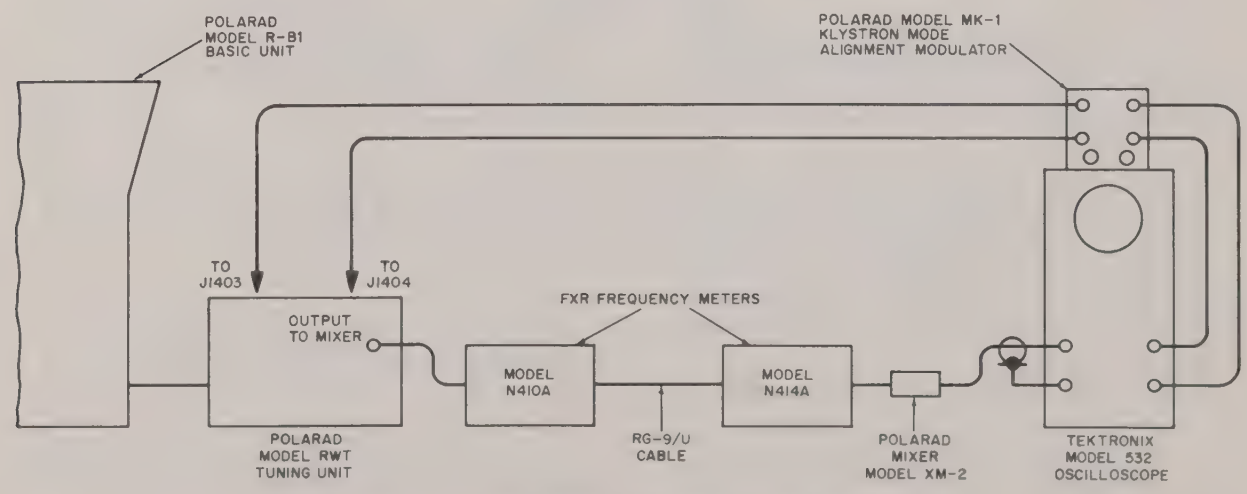

Figure 4-2. Test Setup for Tracking Local Oscillator

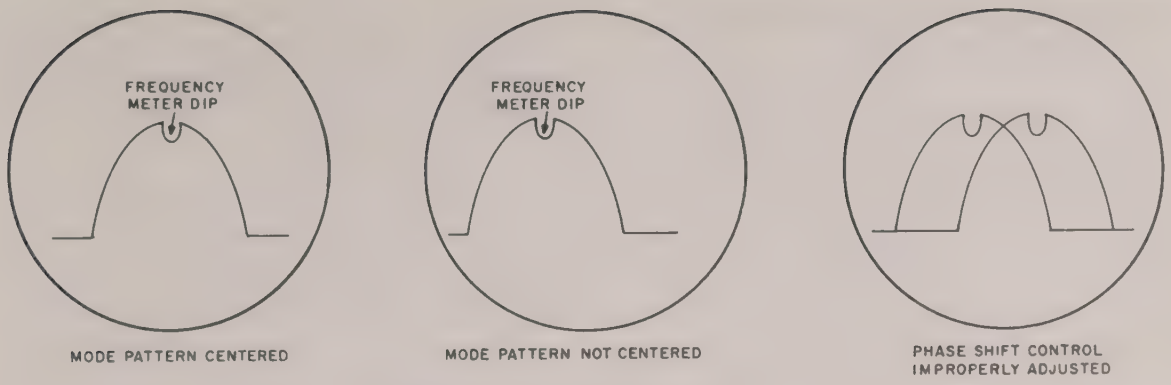

Figure 4-3. Klystron Mode Patterns

Note

All potentiometers located on the tuning unit are provided with shaft locks. Use a 7/16 inch spintype hex wrench to loosen these locknuts. After a shaft adjustment has been completed, be sure to retighten the locknut without disturbing the position of potentiometer control shaft. Use an open-end wrench to prevent the body of the locking device from rotating on its shaft.

k. Perform the tracking adjustments as directed in steps l through p and outlined in Table 4-3.

TABLE 4-3. REPELLER VOLTAGE TRACKING ADJUSTMENTS

Step	Set Frequency Dial to:	If Indication is Not Correct, Adjust:
1	Just below 3000 mc	TRACK 1 ADJ. - R1411
2	Exactly 2150 mc	LOW ADJ. - R1407
3	Just above 3000 mc	TRACK 2 ADJ. - R1412
4	Exactly 4600 mc	HIGH ADJ. - R1405

l. Set the Tuning Head to a frequency slightly less than 3000 mc (just below automatic mode switching point, listen for click of switch). Slowly turn the MK-1 modulation AMP control to its extreme counterclockwise setting. If the dc repeller voltage is correct, the mode trace will disappear symmetrically about its center, with the center portion disappearing last. If this is not the case, adjust TRACK 1 ADJ. R1411 (see figure 4-1) until the correct reflector voltage is obtained and the mode disappears symmetrically about its center.

m. Rotate the RW-T TUNING control to a frequency of 2150 mc. After rotating the modulation AMP control to an appropriate clockwise position, (refer to step i) slowly turn the modulation AMP control to its extreme counterclockwise position. If the mode trace does not disappear symmetrically about its center, adjust LOW ADJ. control R1407 until a symmetrical drop-out of the mode trace is obtained.

n. Tune the RW-T TUNING control to a frequency of 3000 mc (just above the mode switch point). Return the modulation AMP control to a position which produced a complete mode on the oscilloscope. Slowly turn the modulation amplitude control to its extreme counterclockwise position. If the mode trace does not disappear symmetrically about its center, adjust TRACK 2 ADJ. R1412 until a symmetrical drop-out of the mode trace is obtained.

o. Tune the RW-T to a frequency of 4600 mc. After rotating the modulation AMP control to an appropriate clockwise position, slowly turn the modulation AMP control to its extreme counterclockwise position. If the mode trace does not disappear symmetrically about its center, adjust HIGH ADJ. R1405 until a symmetrical drop-out of the mode trace is obtained.

p. The repeller voltage alignment must now be rechecked at both sides of 3000 mc, at 2150 and 4600 mc because of the interacting effects of the adjustment of tracking potentiometers. Repeat steps l through o until the modes are properly centered throughout the range of the Tuning Head.

4-16. ADJUSTMENTS AFTER REPLACEMENT OF TRACK POTENTIOMETER. Whenever tracking potentiometer R1405, R1407, R1411 or R1412 is replaced, the following procedure should be followed:

a. Set the wiper arm of the potentiometer to the center of its range of travel.

b. Perform the bias adjustment as instructed in paragraph 4-10.

c. Perform the repeller tracking adjustments as instructed in paragraph 4-15.

4-17. KLYSTRON LOCAL OSCILLATOR CALIBRATION.

4-18. Variations in tube characteristics will usually require re-calibration of the oscillator circuit whenever the klystron tube is replaced. The equipment and test setup for the oscillator calibration test is the same as those listed in paragraph 4-14. Use equipment setup as shown in figure 4-2. For oscillator calibration and track checking, proceed as follows:

a. Remove the a-c power cord from the rear of the receiver and place the POWER ON switch in the off position.

b. Remove the RW-T Tuning Unit from the cabinet. Sufficient slack in the cabling has been provided so that the tuning unit may be placed on a work bench in front of the basic instrument. Place the tuning unit in a position so that the oscillator cam adjustments are accessible while observing indications on the panel-mounted meter.

c. Remove tuning unit tube V1403 from its socket and turn the AMPLITUDE control fully clockwise.

d. Plug the a-c power cord into the receptacle at the rear of the receiver and place the POWER ON switch in the ON position. Allow the equipment to warm-up for at least ten minutes.

4-19. INITIAL CALIBRATION ADJUSTMENT. Before making any calibration check or adjustments, proceed as follows:

a. Turn the TUNING control of the receiver until the oscillator cam follower is at the fixed section of the tuning cam, adjacent to the two small holes which terminate the arcs of the cam. This will be at a receiver tuning dial reading of approximatley 3500 mc (see figure 4-4).

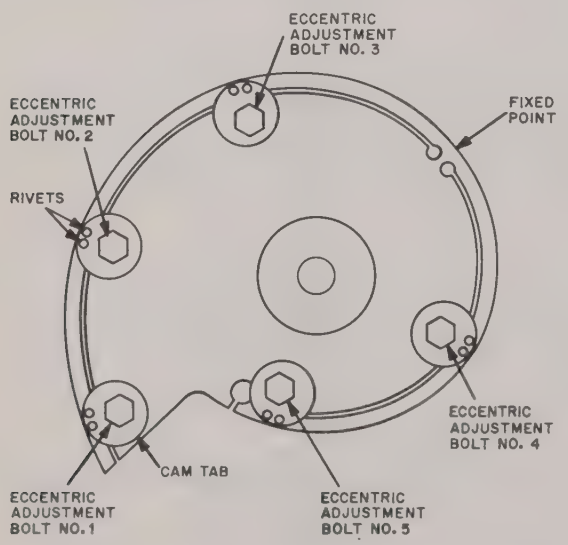

Figure 4-4. Klystron Oscillator Adjustable Tuning Cam

b. Tune the wavemeter until a pip appears at the center of the mode trace on the oscilloscope. If the frequency reading on the wavemeter is within ±1% of the receiver tuning dial reading, no further initial adjustment is required. If an initial adjustment is required, proceed to step c.

c. Tune the wavemeter so it will correspond precisely to the receiver dial reading (3500 mc). As the wavemeter is being tuned to this value the pip on the mode trace on the oscilloscope will move off the center of the mode. Adjust the frequency adjust set screw located on the oscillator drive (figure 4-1) to keep the pip at the center of the mode trace while tuning the wavemeter towards the receiver dial reading. Following the adjustment of the frequency adjust set screw, it is advisable to re-check the tracking adjustments outlined in Table 4-3 and described in steps l through p of paragraph 4-15.

Note

If the repeller voltage tracking adjustment is re-checked as outlined in paragraph 4-15, remove the wavemeter from the circuit and connect the external mixer directly to the OUTPUT TO MIXER jack of the RW-T tuning unit.

4-20. OSCILLATOR TUNING CAM ADJUSTMENT. If the accuracy of the receiver dial is still outside the ±1% tolerance limits after following the procedure of paragraph 4-19, fine adjustments may be made by means of the adjustable oscillator tuning cam (see figure 4-4). Five eccentric hex bolts and five locknuts on the cam are to be adjusted as follows:

CAUTION

EXTREME CAUTION MUST BE EXERCISED DURING THE CAM ADJUSTMENTS TO PREVENT DAMAGE TO THE CAM. DO NOT DEVIATE FROM THE ORDER OF ADJUSTMENT GIVEN IN THESE INSTRUCTIONS AND SHOWN IN FIGURE 4-4.

a. Slightly loosen (approximately 3/4 turn counterclockwise) each of the five nuts on the rear of the tuning cam. These nuts are accessible from the top of the tuning unit.

CAUTION

DO NOT LOOSEN THE NUTS COMPLETELY OR THEY MAY FALL INTO OTHER COMPONENTS ON THE CHASSIS.

b. Rotate the FREQUENCY IN MEGACYCLES dial until the cam follower is adjacent to eccentric adjustment no. 4 on the tuning cam.

c. Turn the no. 4 eccentric adjustable bolt until the reading on the wavemeter is within ±1% of the FREQUENCY IN MEGACYCLES dial reading. Tighten the no. 4 nut while holding the hex-head bolt firmly in the desired position with an open-end wrench. Recheck the wavemeter reading after tightening.

d. Rotate the FREQUENCY IN MEGACYCLES dial until the cam follower is adjacent to eccentric adjustment no. 5. Repeat the procedure outlined in step c.

e. Repeat the adjustments for the three remaining bolts on the tuning cam. Adjust bolts no. 3, no. 2 and no. 1, in that order.

f. At the extreme limits (points 1 and 5, figure 4-4), the adjustment bolt and nut may not fall exactly opposite the cam follower, due to the limits of cam shaft rotation. In this event, adjust the bolt and nut when the adjustment point is as close as possible to the cam follower for the limit dial readings.

4-21. PREAMPLIFIER ALIGNMENT.

4-22. The preamplifier is mounted on the RW-T Tuning Unit. The alignment of this sub-chassis should be checked after replacement of any tubes, or completion of repairs, within the preamplifier. A signal generator having a calibrated output at frequencies from 2 to 4.6 gc is required for this test. The front panel meter of the receiver will be used as an output indicator. To align the preamplifier, proceed as directed in steps a, b and d. To check the alignment of the preamplifier, proceed as directed in step c.

a. Set the controls of the receiver and RW-T Tuning Unit as follows:

(1) Place the MANUAL-CALIBRATE switch in the CALIBRATE position.

(2) Set the AFC ON switch to the off position.

(3) Set the METER SELECTOR switch to the USE position.

(4) Set the FUNCTION SELECTOR switch to the AVERAGE position.

(5) Set the METER SCALE switch to the LIN position.

(6) Set the TUNED AMP switch to the OUT position.

b. Perform the alignment as follows:

(1) With no input signal present, adjust the CALIBRATE GAIN control to obtain a reading of 2 on the linear scale.

(2) Apply a signal to the front panel OUTPUT TO MIXER jack.

(3) Tune the receiver to the generator frequency for maximum pointer deflection on the panel-mounted meter.

(4) Adjust the signal generator attenuator to obtain a half-scale pointer deflection on the meter.

(5) Tune i-f transformers T1451, T1452, and inductor L1451 (see figure 4-5) for a maximum pointer deflection on the panel-mounted meter.

c. To determine sensitivity of entire unit, retain control settings of the receiver as indicated in a and b of this paragraph. From no-signal input, increase generator output until pointer deflects to a reading of 2.8 on the linear scale. Read sensitivity on the generator attenuator. It should read approximately -100 dbm.

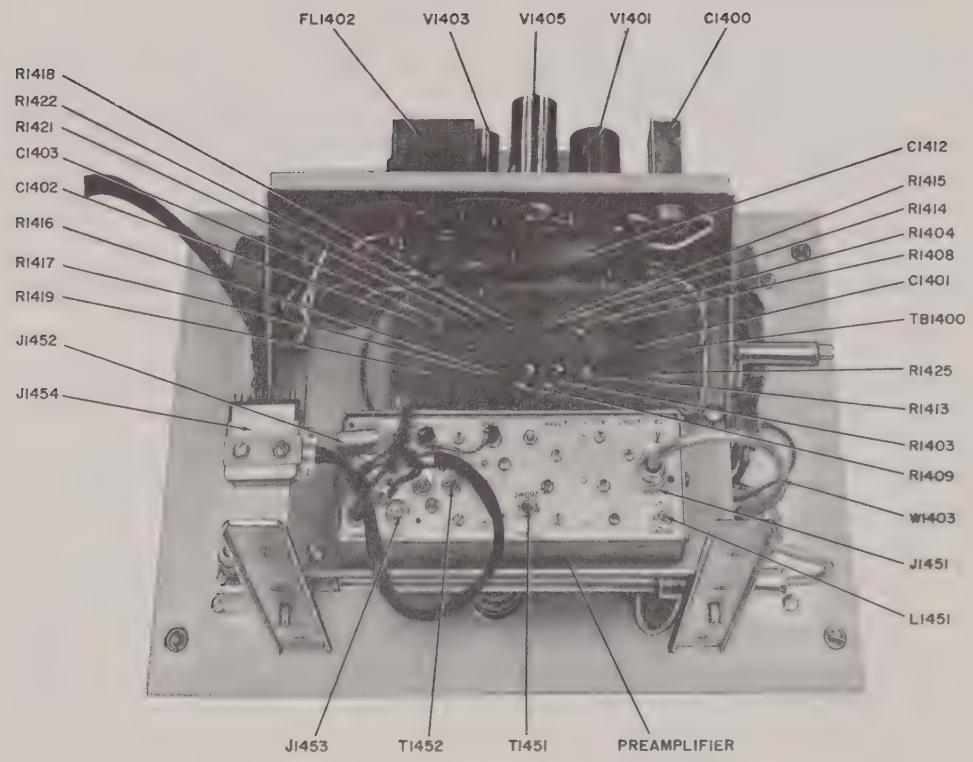

Figure 4-5. Model RW-T Tuning Unit, Bottom Rear View

SECTION V
SCHEMATIC DIAGRAM

5-1. GENERAL.

5-2. This section contains the schematic diagram of the Model RW-T Tuning Unit. This diagram is to be used in conjunction with Section III to help the technician understand the operation of the tuning unit and with Section IV to facilitate troubleshooting and maintenance operations. The schematic diagrams of the various assemblies of the Model R-B1 Basic Unit are contained in Section V of the Model R handbook.

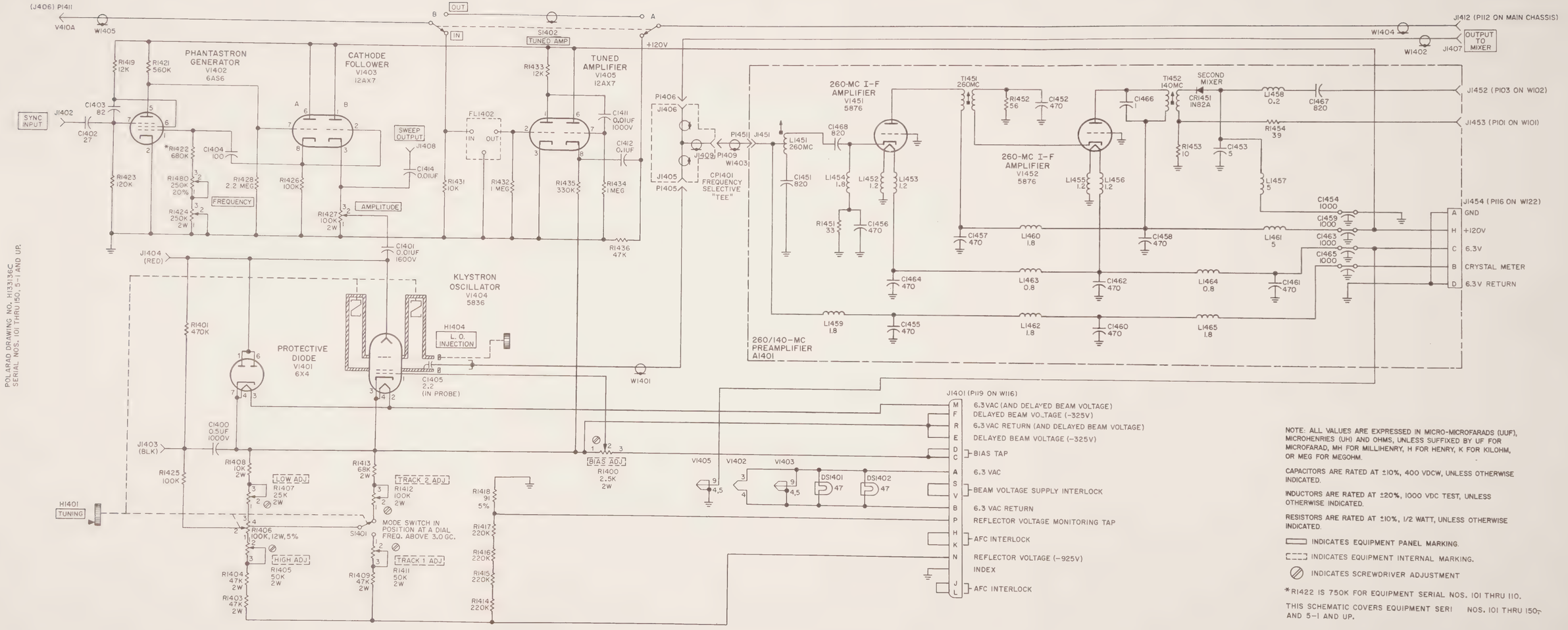

Figure 5-1. Model RW-T Tuning Unit, Schematic Diagram

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This parts list provides an alpha-numerical listing, in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the equipment.

6-3. ORDERING INFORMATION. Orders for parts should contain the following information:

a. Equipment name and model.
b. Serial number.
c. Reference symbol of part.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST.

6-5. An explanation of the structure of the parts list, Table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See Figure 6-1.)

1 2 3 4 5 6 7

TABLE 6-2. PARTS LIST

SECTION VI
PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
C101	CAPACITOR, CERAMIC, 2000UUF, 10 PCT, 500WVDC /POLARAD PART NO. B704888	BCD-D1-4	FY	1
C102	NOT USED			
C103 AND C104	SAME AS C101			
S101 THRU S104	SWITCH, ROTARY, 4 SECT, 6 WAFERS, 6 POSITIONS	C23346	BE	1
TB101	TERMINAL BOARD, COMPONENT ASSY	C115625	BE	1
W108	CABLE ASSY, RF	C147158	BE	1
XF101 AND XF102	FUSEHOLDER/POLARAD PART NO. 005236	HKP-HW	EG	1
XV101 THRU XV106	SOCKET, ELECTRON TUBE	TS101P01	AU	1
V101	ELECTRON TUBE	6021	CK	2

Figure 6-1. Parts List Example

6-6. REFERENCE SYMBOL COLUMN. The reference symbol column (1, Figure 6-1) contains the reference symbol assigned to each part, which also identifies the part on the schematic diagram or in an illustration. The listing is in alpha-numerical order.

6-7. DESCRIPTION COLUMN. The description column (2) contains the description for each part. When the same part is used more than once in the equipment, the second and subsequent listings for that part use the phrase "SAME AS ___" (4) in the description column and the remaining columns (5, 6, and 7) are left blank. When a reference symbol designation has not been used or its assignment has been cancelled, the description column contains the phrase "NOT USED" (3).

6-8. MANUFACTURER'S PART NUMBER COLUMN. The manufacturer's part number column (5) contains the part number assigned by the manufacturer of the part, except for "SAME AS ___" and "NOT USED" listings.

6-9. MANUFACTURER'S CODE COLUMN. The manufacturer's code column (6) contains a letter code identifying the manufacturer of the part. Table 6-1 contains a listing of the letter codes and the manufacturers names and addresses.

6-10. MAINTENANCE QUANTITY COLUMN. The maintenance quantity column (7) contains the recommended maintenance quantity for each part, based on a one year requirement for an equipment in operation for 10 hours a day throughout the year. The recommended maintenance quantities will provide a high degree of equipment reliability in areas where an adequate supply of replacement parts is not available. The recommended maintenance quantity is listed for the initial occurrence of the part in the parts list, but covers all subsequent listings.

6-11. To determine recommended maintenance quantity for periods other than one year, multiply the one-year quantity by the desired period, expressed in years.

6-12. To determine recommended maintenance quantity for operating periods other than 10 hours per day, use the equation given below.

$$MQ' = MQ \times \frac{HR_{op}}{10}$$

where: MQ = Maintenance quantity from Table 6-2

MQ' = Maintenance quantity for desired operating period

HR_{op} = Operating period in hours

Round off the quantity obtained to the nearest whole number.

TABLE 6-1. MANUFACTURER'S CODE

CODE	NAME AND ADDRESS
C	Alden Products Co., Brockton, Mass.
D	Allen-Bradley Co., Milwaukee, Wis.
P	Centralab Division of Globe-Union, Inc., Milwaukee, Wis.
R	Cinch Mfg. Co., Division of United-Carr Fastener Corp., Chicago, Ill.
W	Hugh H. Eby Co., Philadelphia, Pa.
Y	Erie Resistor Corp., Erie, Pa.
AU	Military Specifications
AV	Military Standards
AX	Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.
BE	Polarad Electronics Corp., Long Island City, N. Y.
BH	Raytheon Co., Industrial Components Division, Industrial Tube Operation, Newton, Mass.
BN	Sprague Electric Co., North Adams, Mass.
BW	United Transformer Co., New York, N. Y.
CC	Winchester Electronics Co., Inc., Norwalk, Conn.
CK	Commercially Available Component
CL	Stackpole Carbon Co., St. Marys, Pa.
DR	CTS Corp., Elkhart, Ind.
EG	Bussmann Fuse Division of McGraw-Edison Co., St. Louis, Mo.
FD	Kulka Electric Corp., Mount Vernon, N. Y.
FY	Hi-Q Division of Aerovox Corp., Myrtle Beach, S. C.

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	MODEL RW-T TUNING UNIT			
A1401	PREAMPLIFIER ASSY, 260/140MC, USED IN TUNING UNIT SERIAL NOS. 101 THRU 150 AND 5-1 AND UP. (SEE TABLE 6-3)			
A1402	SWITCH AND POTENTIOMETER ASSY	B25631	BE	1
CP1401	TEE,FREQUENCY SELECTIVE	C133941	BE	1
C1400	CAPACITOR,PAPER,0.5UF,20 PCT,1000WVDC	CP91B1FG504M	AU	1
C1401	CAPACITOR,PAPER,0.01UF,1600WVDC /POLARAD PART NO. B509116	MB-S1	BN	1
C1402	CAPACITOR,MICA,27UUF,10 PCT,300WVDC	CM15B270K	AU	1
C1403	CAPACITOR,MICA,82UUF,10 PCT,300WVDC	CM20B820K	AU	1
C1404	CAPACITOR,MICA,100UUF,5 PCT,500WVDC	CM15E101J	AU	1
C1405	CAPACITOR,COMPOSITION,2.2UUF,5 PCT,500WVDC /POLARAD PART NO. A709673	GA-2.2UUF5PCT	CL	1
C1406 THRU C1410	NOT USED			
C1411	CAPACITOR,CERAMIC,0.01UF,GMV,1000WVDC /POLARAD PART NO. A705177	DD-103	P	1
C1412	CAPACITOR,PLASTIC,0.1UF,20 PCT,400WVDC /POLARAD PART NO. B508828	160P10404	BN	1
C1413	NOT USED			
C1414	CAPACITOR,PLASTIC,0.01UF,20 PCT,400WVDC /POLARAD PART NO. B508816	160P10304	BN	1
DS1401 AND DS1402	LAMP,INCANDESCENT,6-8V,BAYONET BASE /POLARAD PART NO. 005237	47	CK	2
FL1401	FILTER ASSY,LOW-PASS, NON-REPLACEABLE PART OF CP1401			
F1402	FILTER,BANDBASS,1000CPS /POLARAD PART NO. A138047	BM1-1000	BW	1
H1401	KNOB/POLARAD PART NO. 507302	175-6-2	BH	1
H1402 AND H1403	KNOB/POLARAD PART NO. A707468	70-2WD-2	BH	1
H1404	KNOB/POLARAD PART NO. 517207	90-2-2	BH	1
J1401	CONNECTOR,RECEPTACLE,MALE,18 PINS /MODIFIED CC PART NO. SA18P	A23207	BE	1
J1402	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-625/U	AU	1
J1403	JACK,TEST POINT,BLACK/POLARAD PART NO. 541403	1108CS-BLACK	C	1
J1404	JACK,TEST POINT,RED/POLARAD PART NO. 541401	1108CS-RED	C	1
J1405 AND J1406	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE, NON-REPLACEABLE PART OF CP1401			
J1407	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-909/U	AU	1
J1408	SAME AS J1402			
J1409	CONNECTOR,RECEPTACLE,FEMALE,N TYPE, NON-REPLACEABLE PART OF CP1401			
J1410 AND J1411	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
J1412	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-261B/U	AU	1
MP1401	KLYSTRON COVER AND SOCKET ASSY	BK50146	BE	1
MP1402	ACTUATOR,SWITCH/POLARAD PART NO. A700051	JV-5	AX	1
P1401 THRU P1404	NOT USED			
P1405 AND P1406	CONNECTOR,PLUG,MALE,BNC TYPE	UG-88/U	AU	1
P1407 AND P1408	NOT USED			
P1409	CONNECTOR,PLUG,MALE,N TYPE	UG-536A/U	AU	1
P1410	NOT USED			
P1411	CONNECTOR,PLUG,MALE,BNC TYPE	UG-260B/U	AU	1
P1412 THRU P1450	NOT USED			
P1451	SAME AS P1405			
R1400	RESISTOR,VARIABLE,COMPOSITION,2.5K,10 PCT,2W /POLARAD PART NO. 517845	JA2N056S252A	D	1
R1401	RESISTOR,COMPOSITION,470K,10 PCT,1/2W /MIL STD PART NO. MS35043-29	RC20GF474K	AU	1
R1402	NOT USED			
R1403 AND R1404	RESISTOR,COMPOSITION,47K,10 PCT,2W /MIL STD PART NO. MS35045-23	RC42GF473K	AU	1
R1405	RESISTOR,VARIABLE,COMPOSITION,50K,10 PCT,2W /MODIFIED D PART NO. JA2N232S503A	A138074	BE	1
R1406	RESISTOR,VARIABLE,WW,100K,5 PCT,12W	BK5413	BE	1
R1407	RESISTOR,VARIABLE,COMPOSITION,25K,10 PCT,2W /POLARAD PART NO. 517851	JA2N056S253A	D	1
R1408	RESISTOR,COMPOSITION,10K,10 PCT,2W /MIL STD PART NO. MS35045-19	RC42GF103K	AU	1
R1409	SAME AS R1403			
R1410	NOT USED			
R1411	RESISTOR,VARIABLE,COMPOSITION,50K,10 PCT,2W /POLARAD PART NO. 517853	JA2N056S503A	D	1
R1412	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT,2W /MODIFIED D PART NO. JA2N232S104A	A138075	BE	1
R1413	RESISTOR,COMPOSITION,68K,10 PCT,2W /MIL STD PART NO. MS35045-24	RC42GF683K	AU	1
R1414 THRU R1417	RESISTOR,COMPOSITION,220K,10 PCT,1/2W /MIL STD PART NO. MS35043-27	RC20GF224K	AU	1
R1418	RESISTOR,COMPOSITION,91 OHMS,5 PCT,1/2W /MIL STD PART NO. MS35043-62	RC20GF910J	AU	1
R1419	RESISTOR,COMPOSITION,12K,10 PCT,1/2W /MIL STD PART NO. MS35043-210	RC20GF123K	AU	1
R1420	NOT USED			

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
R1421	RESISTOR,COMPOSITION,560K,10 PCT,1/2W /MIL STD PART NO. MS35043-220	RC20GF564K	AU	1
R1422	RESISTOR,COMPOSITION,750K,10 PCT,1/2W, USED ON SERIAL NOS. 101 THRU 110	RC20GF754K	AU	1
R1422	RESISTOR,COMPOSITION,680K,10 PCT,1/2W /MIL STD PART NO. MS35043-30/ USED ON SERIAL NOS. 111 THRU 150 AND 5-1 AND UP	RC20GF684K	AU	1
R1423	RESISTOR,COMPOSITION,120K,10 PCT,1/2W /MIL STD PART NO. MS35043-216	RC20GF124K	AU	1
R1424	RESISTOR,VARIABLE,COMPOSITION,250K,10 PCT,2W /POLARAD PART NO. 517925	JA2N056S254A	D	1
R1425 AND R1426	RESISTOR,COMPOSITION,100K,10 PCT,1/2W /MIL STD PART NO. MS35043-25	RC20GF104K	AU	1
R1427	RESISTOR,VARIABLE,COMPOSITION,100K,10 PCT,2W /POLARAD PART NO. 517923	JA2N056S104A	D	1
R1428	RESISTOR,COMPOSITION,2.2 MEGO,10 PCT,1/2W /MIL STD PART NO. MS35043-33	RC20GF225K	AU	1
R1429 AND R1430	NOT USED			
R1431	RESISTOR,COMPOSITION,10K,10 PCT,1/2W /MIL STD PART NO. MS35043-19	RC20GF103K	AU	1
R1432	RESISTOR,COMPOSITION,1 MEGO,10 PCT,1/2W /MIL STD PART NO. MS35043-31	RC20GF105K	AU	1
R1433	SAME AS R1419			
R1434	SAME AS R1432			
R1435	RESISTOR,COMPOSITION,330K,10 PCT,1/2W /MIL STD PART NO. MS35043-28	RC20GF334K	AU	1
R1436	RESISTOR,COMPOSITION,47K,10 PCT,1/2W /MIL STD PART NO. MS35043-23	RC20GF473K	AU	1
R1437 THRU R1479	NOT USED			
R1480	RESISTOR,VARIABLE,COMPOSITION,250K,20 PCT, 1/2W/POLARAD PART NO. B131659/ USED ON SERIAL NOS. 111 THRU 150 AND 5-1 AND UP	X3539	DR	1
S1401	SWITCH,SENSITIVE,SPDT/POLARAD PART NO. A20438	V3-13	AX	1
S1402	SWITCH,TOGGLE,DPDT	MS25100-23	AV	1
TB1400	TERMINAL BOARD,COMPONENT ASSY	B133895	BE	1
TB1401	TERMINAL BOARD/POLARAD PART NO. B704559	600-4	FD	1
V1401	ELECTRON TUBE	6X4	CK	2
V1402	ELECTRON TUBE	6AS6	CK	2
V1403	ELECTRON TUBE	12AX7	CK	4
V1404	ELECTRON TUBE,KLYSTRON,1500-6000MC	5836	BH	1
V1405	SAME AS V1403			
W1401	CABLE AND ATTENUATOR PROBE ASSY	B132643	BE	1

TABLE 6-2. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
W1402	CABLE ASSY,RF,RG-55/U	A138048	BE	1
W1403	CABLE ASSY,RF,RG-55/U	A138049	BE	1
W1404	CABLE ASSY,RF,RG-62/U	A138115	BE	1
W1405	CABLE ASSY,RF,RG-62/U	A138114	BE	1
XV1401	SOCKET,ELECTRON TUBE/POLARAD PART NO. 050075	8290	W	1
XV1402	SOCKET,ELECTRON TUBE	TS102C01	AU	1
XV1403	SOCKET,ELECTRON TUBE	TS103C01	AU	1
XV1404	NOT USED			
XV1405	SAME AS XV1403			
	SUPPLIED ACCESSORIES			
A1403	ACCESSORY KIT	A146912	BE	1
A1404	COAXIAL MIXER ASSY/POLARAD MODEL NO. XM-2	A138087	BE	1
CP1402	CRYSTAL DETECTOR	A138089	BE	1
CP1403	CONNECTOR,ADAPTER,UHF TYPE TO BNC TYPE	UG-273/U	AU	1
CR1401	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N23C	CK	5
	OPTIONAL ACCESSORIES			
A1501	X-BAND WAVEGUIDE MIXER,8200-12400MC /POLARAD MODEL NO. XM-8	A138091	BE	1
A1502	KU-BAND WAVEGUIDE MIXER,12400-18000MC /POLARAD MODEL NO. XM-12	A138092	BE	1
A1503	K-BAND WAVEGUIDE MIXER,18000-26500MC /POLARAD MODEL NO. XM-18	A138093	BE	1
A1504	KA-BAND WAVEGUIDE MIXER,26500-40000MC /POLARAD MODEL NO. XM-26	A138094	BE	1
A1505	Q-BAND WAVEGUIDE MIXER,33000-50000MC /POLARAD MODEL NO. XM-33	A138095	BE	1
A1506	V-BAND WAVEGUIDE MIXER,50000-75000MC /POLARAD MODEL NO. XM-50	A138119	BE	1
CR1501	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N23C	CK	5
CR1502	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N78	CK	5
CR1503	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N26	CK	5
CR1504 THRU CR1506	SEMICONDUCTOR DEVICE,DIODE,CRYSTAL,SILICON	1N53	CK	15

TABLE 6-3. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
	260/140MC PREAMPLIFIER ASSY, A1401			
A1401	PREAMPLIFIER ASSY,260/140MC	C143768	BE	1
CR1401 THRU CR1450	NOT USED			
CR1451	SEMICONDUCTOR DEVICE,DIODE,GERMANIUM	1N82A	CK	5
C1401 THRU C1450	NOT USED			
C1451	CAPACITOR,CERAMIC,820UUF,10 PCT,500WVDC	CK60Y821K	AL	1
C1452	CAPACITOR,MICA,470UUF,10 PCT,300WVDC	CB21QY471K	AL	1
C1453	CAPACITOR,CERAMIC,5UUF,0.5UUF TOL,500WVDC	CC21CH050D	AL	1
C1454	CAPACITOR,CERAMIC,FEED-THRU,1000UUF,20 PCT, 500WVDC/PCLARAD PART NO. A506409	327X5S102M	Y	1
C1455 THRU C1458	SAME AS C1452			
C1459	SAME AS C1454			
C1460 THRU C1462	SAME AS C1452			
C1463	SAME AS C1454			
C1464	SAME AS C1452			
C1465	SAME AS C1454			
C1466	CAPACITOR,CERAMIC,1UUF,0.25UUF TOL,500WVDC	CC20CK010C	AL	1
C1467 AND C1468	CAPACITOR,CERAMIC,820UUF,PLUS 100 PCT, MINUS 20 PCT,500WVDC	CK60Y821Z	AL	1
J1401 THRU J1450	NOT USED			
J1451	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE	UG-625A/U	AL	1
J1452	CONNECTOR,RECEPTACLE,FEMALE,BNC TYPE,RT ANGLE	UG-1098/U	AL	1
J1453	SAME AS J1451			
J1454	CONNECTOR,PLUG,MALE,9 PINS,WITH MODIFIED HOOD /PCLARAD PART NO. 8704850	MRE7-2P-G	CC	1
L1401 THRU L1450	NOT USED			
L1451	COIL,RF	A27455	BE	1
L1452 AND L1453	COIL,RF,1.2UH	A27453	BE	1
L1454	COIL,RF,1.8UH	A27454	BE	1
L1455 AND L1456	SAME AS L1452			
L1457	COIL,RF,5UH	A27146	BE	1
L1458	COIL,RF,0.2UH	A27601	BE	1
L1459 AND L1460	SAME AS L1454			

TABLE 6-3. PARTS LIST (CONT'D)

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	MAINT QTY
L1461	COIL,RF,5UH	A27129	BE	1
L1462	SAME AS L1454			
L1463	COIL,RF,0.8UH	A27452	BE	1
L1464	COIL,RF,0.8UH	A27144	BE	1
L1465	SAME AS L1454			
R1401 THRU R1450	NOT USED			
R1451	RESISTOR,COMPOSITION,33 OHMS,10 PCT,1/2W /MIL STD PART NO. MS35043-4	RC20GF330K	AU	1
R1452	RESISTOR,COMPOSITION,56 OHMS,10 PCT,1/2W /MIL STD PART NO. MS35043-196	RC20GF560K	AU	1
R1453	RESISTOR,COMPOSITION,10 OHMS,10 PCT,1/2W /MIL STD PART NO. MS35043-1	RC20GF100K	AU	1
R1454	RESISTOR,COMPOSITION,39 OHMS,10 PCT,1/2W /MIL STD PART NO. MS35043-195	RC20GF390K	AU	1
T1401 THRU T1450	NOT USED			
T1451	TRANSFORMER,RF,VARIABLE	A27456	BE	1
T1452	TRANSFORMER,RF,VARIABLE	A27457	BE	1
V1401 THRU V1450	NOT USED			
V1451 AND V1452	ELECTRON TUBE	5876	CK	4
XV1401 THRU XV1450	NOT USED			
XV1451 AND XV1452	SOCKET,ELECTRON TUBE/POLARAD PART NO. A107688	54A16325	R	1

POLARAD

POLARAD ELECTRONIC INSTRUMENTS

A DIVISION OF POLARAD ELECTRONICS CORPORATION

34-02 QUEENS BOULEVARD · LONG ISLAND CITY 1, N Y · AREA CODE 212 · EXETER 2-4500

REQUEST FOR MAINTENANCE

FROM:

COMPANY NAME _____ DATE: _____

ADDRESS: _____ INDIVIDUAL _____

_____ POSITION _____

SECTION OR DIVISION _____ PHONE NO. _____ EXT. _____

_____

EQUIPMENT _____ DATE OF PURCHASE _____

MODEL _____ SERIAL NO. _____ ORDER NO. _____

_____

TROUBLE REPORT:

A. Description of trouble _____

_____

_____

_____

_____

_____

B. Has trouble been localized? _____ If so, how and where: _____

_____

_____

_____

_____

_____

C. Instruments used and measurements taken, if any: _____

_____

_____

_____

D. Is trouble intermittent? _____

E. Hours of operation prior to this trouble _____

F. Date trouble occurred _____

G. Was factory consulted by telephone or letter prior to this request? _____

If so, give date and person to whom directed: _____

_____

H. Additional Comments: _____

_____

_____

_____

_____

_____

_____

When trouble develops requiring factory assistance, complete this form and send to:

Polarad Electronic Instruments
Division of
Polarad Electronics Corporation
34-02 Queens Boulevard
Long Island City 1, New York
ATTENTION: Service Department

After this report has been analyzed by the Service Department, you will be notified when a field service engineer will call on you to make the necessary repairs. If your trouble can best be corrected at the factory, we will so notify you with instructions and authorization for returning the equipment.

NO EQUIPMENT MAY BE RETURNED TO THE FACTORY WITHOUT WRITTEN AUTHORIZATION

POLARAD ELECTRONIC INSTRUMENTS
34-02 Queens Boulevard
Long Island City, New York 11101

POLARAD VELOCITRONS®

WARRANTY AND CLAIM REPORT

NOTE: Please answer all questions since no claim will be processed without this information.

FROM:

NAME: _____

COMPANY: _____

ADDRESS: _____

PERSON TO CONTACT FOR FURTHER INFORMATION:

NAME: _____

COMPANY: _____

ADDRESS: _____

DATE: _____ TUBE TYPE: _____ SERIAL NO.: _____

TUBE USED IN POLARAD EQUIPMENT: _____ MODEL NO.: _____

THIS IS: ORIGINAL: _____ REPLACEMENT: _____ DATE TUBE RECEIVED: _____

DATE TUBE PLACED IN SERVICE: _____ DATE OF TUBE FAILURE: _____ YOUR PURCHASE ORDER NO.: _____

NO. DAYS IN SERVICE: _____ HRS. SERVICE PER DAY: _____ TOTAL FILAMENT HRS.: _____

DESCRIPTION OF FAILURE: _____

_____

_____

OPERATING CONDITIONS: _____

_____

_____

WAS FAILURE VERIFIED BY SECOND TEST?: _____

_____
Signature

POLARAD ELECTRONIC INSTRUMENTS
34-02 Queens Boulevard
Long Island City, New York 11101

WARRANTY AND CLAIM REPORT

Important: No claim will be processed unless all conditions on this sheet are met. Please answer all questions on the reverse side of this sheet and place this sheet with the tube to be returned.

WARRANTY

This tube is warranted by Polarad Electronic Instruments (Division of Polarad Electronics Corporation) to be free from manufacturing defects for 12 months from date of purchase or 500 hours filament life whichever occurs first. Allowances for premature failure will be pro-rated on the basis of remaining guaranteed filament life or remaining months in this 12 month period whichever is lesser credit. No claims will be processed if either of the above mentioned periods has expired.

RETURN TUBE PROCEDURE

1. Buyer must inspect tubes electrically and mechanically upon receipt so that in the event of damage, claim can be promptly filed with carrier.

2. No tube may be returned to Polarad without first obtaining permission from the manufacturer.

3. When possible, re-pack the tube in its original container. If this is not possible, package the tube in at least an equivalent container. This is important since no allowances will be made on broken tubes and any risk of damage must be assumed by the sender.

4. Transportation charges on all returns must be prepaid by the sender.

POLARAD

WORLD LEADER IN MICROWAVE INSTRUMENTATION